Stuttgarter Beiträge zur Naturkunde
Serie A (Biologie)

Herausgeber:

Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart

Stuttgarter Beitr. Naturk.	Ser. A	Nr. 662	74 S., 119 Abb., 1 Tab.	Stuttgart, 14. VI. 2004

The terrestrial isopods (Isopoda: Oniscidea) of Crete and the surrounding islands

Helmut Schmalfuss, Kaloust Paragamian & Spyros Sfenthourakis

Abstract

The investigation of recently collected material of terrestrial isopods from Crete yielded 7 species new to science (*Graeconiscus guanophilus* **n. sp.**, *Graeconiscus kournasensis* **n. sp.**, *Trachelipus cavaticus* **n. sp.**, *Armadillidium lymberakisi* **n. sp.**, *Platanosphaera kournasensis* **n. sp.**, *Schizidium delmastroi* **n. sp.**, *Trichodillidium mylonasi* **n. sp.**). Further 7 species are recorded for the first time from the Cretan Archipelago (*Armadilloniscus ellipticus*, *Rodoniscus anophthalmus*, *Philoscia univittata*, *Platyarthrus beieri*, *Platyarthrus lindbergi*, *Agabiformius obtusus*, *Proporcellio quadriseriatus*). New synonyms: *Cretoniscellus* Vandel, 1958 = *Graeconiscus* Strouhal, 1940, **n. syn.**; *Minoscellus* Vandel, 1958 = *Graeconiscus* Strouhal, 1940, **n. syn.**; *Calconiscellus aegaeus* Schmalfuss, 1972 = *Graeconiscus thermophilus* (Çağlar, 1948), **n. syn.** Altogether 55 species are now known from Crete and its surrounding islands.

The new species are described and figured, for most of the other species newly collected material is reported. For a number of species figures of the diagnostic characters are given, taxonomic questions are discussed and distribution maps are added. The distribution of all species on the Cretan Archipelago is summarised in a table. A key helps to identify the species known from Crete. Ecology and biogeography of the Cretan isopod fauna are discussed.
Keywords: Isopoda, Oniscidea, Greece, Crete, new species, new records, key, biogeography.

Zusammenfassung

Bei der Untersuchung neuer Landisopoden-Aufsammlungen von Kreta und der umliegenden Inseln wurden 7 neue Arten entdeckt (*Graeconiscus guanophilus* **n. sp.**, *Graeconiscus kournasensis* **n. sp.**, *Trachelipus cavaticus* **n. sp.**, *Armadillidium lymberakisi* **n. sp.**, *Platanosphaera kournasensis* **n. sp.**, *Schizidium delmastroi* **n. sp.**, *Trichodillidium mylonasi* **n. sp.**). Weitere 7 Arten wurden zum ersten Male vom kretischen Archipel festgestellt (*Armadilloniscus ellipticus*, *Rodoniscus anophthalmus*, *Philoscia univittata*, *Platyarthrus beieri*, *Platyarthrus lindbergi*, *Agabiformius obtusus*, *Proporcellio quadriseriatus*). Neue Synonyme: *Cretoniscellus* Vandel, 1958 = *Graeconiscus* Strouhal, 1940, **n. syn.**; *Minoscellus* Vandel, 1958 = *Graeconiscus* Strouhal, 1940, **n. syn.**; *Calconiscellus aegaeus* Schmalfuss, 1972 = *Graeconiscus thermophilus* (Çağlar, 1948), **n. syn.** Insgesamt sind jetzt 55 Landisopoden-Arten von Kreta und den umliegenden Inseln bekannt.

Die neuen Arten werden beschrieben und abgebildet, für die meisten der anderen Arten wird neues Material angeführt. Für einige Arten werden diagnostische Merkmale abgebildet, taxonomische Fragen diskutiert und ihre Verbreitung wird auf Karten dargestellt. Die Verbreitung aller Arten auf dem kretischen Archipel wird in einer Tabelle zusammengefasst. Ein

SHOUT
SHARE
IT

Schlüssel hilft, die von Kreta bekannten Arten zu bestimmen. Ökologie und Biogeografie der kretischen Isopoden-Fauna werden diskutiert.

Contents

1 Introduction 2
2 Species accounts 4
2.1 Annotations 4
2.2 Family Ligiidae 5
2.3 Family Tylidae 5
2.4 Family Styloniscidae 6
2.5 Family Trichoniscidae 6
2.6 Family Detonidae 17
2.7 Family Bathytropidae 17
2.8 Family Philosciidae 17
2.9 Family Halophilosciidae 20
2.10 Family Trachelipodidae 20
2.11 Family Agnaridae 30
2.12 Family Platyarthridae 31
2.13 Family Porcellionidae 31
2.14 Family Armadillidiidae 36
2.15 Family Armadillidae 61
3 Identification key for the species of the archipelago of Crete 62
4 Discussion 65
5 References 70

1 Introduction

A first comprehensive overview of the terrestrial isopods of Crete was published more than 30 years ago (Schmalfuss 1972a). This publication contained records of 38 species. During the past decades a number of new species and new records were discovered by colleagues from the University of Crete and from abroad (see acknowledgments) and by the authors. One of them (K. Paragamian) has collected isopods in nearly all known caves of Crete. Additionally, the systematic situation has changed for a number of species, and we suggest further changes in the present paper.

Altogether the number of terrestrial isopod species known from Crete by now has increased to 55, including 7 new species and 7 new records for Crete. In the present paper we summarise the current knowledge of the Cretan terrestrial isopod fauna, describe the new species, try to clarify systematic problems and discuss some ecological and biogeographical aspects.

The family arrangement follows Erhard (1998) concerning higher systematic categories. The phylogenetic relations and thus the family arrangement inside the Crinocheta is still debated (compare Schmidt 2003).

The examined material is deposited in the State Museum of Natural History Stuttgart/Germany, in the Natural History Museum of Crete in Irákleio/Greece, and in the personal collections of the second and third author. Fig. 1 shows a map of Crete with the names and the boundaries of the four prefectures, the three main mountain ranges and the surrounding islands. On Fig. 2 the 52 caves mentioned in the species accounts are localised.

Fig. 1. Map of the study area. On the island of Crete the four prefectures mentioned in the text are shown, as well as the major towns and mountain massifs. The surrounding islets are: 1. Pontikonísi, 2. Ágria Gramvoúsa, 3. Gávdos, 4. Paximádia, 5. Día, and 6. Avgó. The elevation contours are intervals of 400 m (400–2400 m).

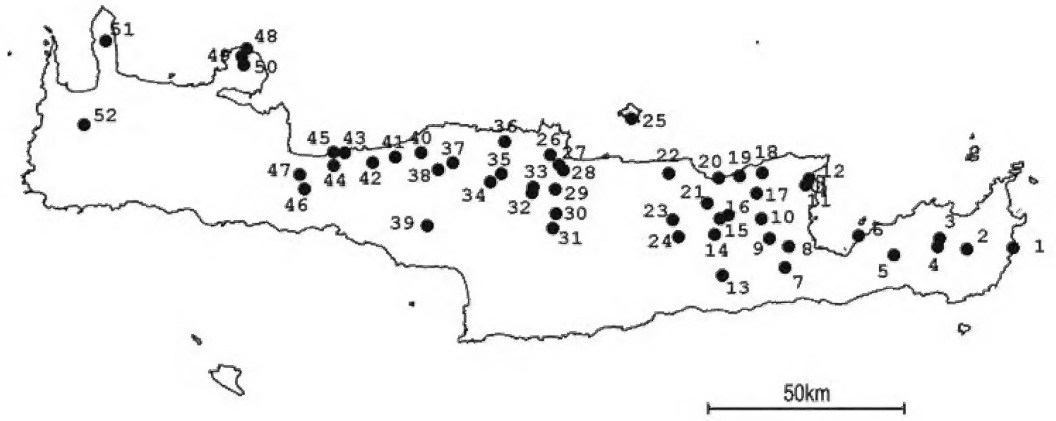


Fig. 2. Locations of caves mentioned in the text. 1. Cave Sta Pelekitá (Káto Zákros), 2. Cave Óxo Latsídi (Sítanos), 3. Cave Mikró Katofýgi (Ágios Geórgios), 4. Cave Megálo Katofýgi (Ágios Geórgios), 5. Cave Ágios Stavrós (Chrysopigí), 6. Cave Therióspilos (Kavoúsi), 7. Cave Toú Sfakianoú i Trýpa (Kalamáfka), 8. Cave Trýpa sto Selí (Kroústas), 9. Cave Gaidourótrypa (Kritsá), 10. Cave Atziganóspilios (Adrianoú), 11. Cave Achnístres (Pinés), 12. Cave Latsída sta Lakkiá (Pinés), 13. Cave Apoloústres (Péfkoi), 14. Cave Diktaíon Ántron (Psychró), 15. Pothole Xepatoméni Latsída (Lagoú), 16. Cave Trapéza (Tzermiádo), 17. Cave Peristerás (Vrachási), 18. Cave of Mílatos, 19. Cave Achnístres (Mílatos), 20. Cave Tis Margiás of Spílios (Mália), 21. Cave Faneroméni (Avdoú), 22. Cave Agía Paraskeví (Skoteinó), 23. Cave Monís Kaléri (Kastélli), 24. Cave Schistá (Agía Paraskeví), 25. Pothole Agrimótrypa (Día Island), 26. Cave Dóxa (Márathos), 27. Cave Sávva Vardáki (Týlissos), 28. Cave Kamilári (Týlissos), 29. Cave Chainóspilios (Kamaráki), 30. Cave of Sárchos, 31. Cave Nychteridóspilios (Áno Asítes), 32. Pothole Lakkí Kodári (Goniés), 33. Pothole Póros Stenoú Lagkoú (Goniés), 34. Cave Sfendóni (Zonianá), 35. Pothole Xepatoménos Táfkos (Axós), 36. Cave Moúgkri (Síses), 37. Cave Lámia (Margarítes), 38. Artificial Cave at Prinés, 39. Cave Marilé Trýpa (Elénes), 40. Cave of Érfoi, 41. Cave Nychteridóspilios (Maroulás), 42. Cave of Mýloi, 43. Cave Simonéli (Alykés, Réthymno), 44. Cave Peiratoú (Zourída gorge, Réthymno), 45. Cave of Geráni, 46. Cave Afroimoú (Así Goniá), 47. Cave of Kournás, 48. Cave Achyróspilio (Chordáki), 49. Cave Katholikó (Chordáki), 50. Cave Arkalóspilios (Akrotíri peninsula), 51. Cave Folí (Afráta), 52. Cave Agía Sofía (Topólia).

Abbreviations

KPPC	Personal collection of KALOUST PARAGAMIAN
NHMC	Natural History Museum of Crete, Irákleio/Greece
pref.	prefecture (as a translation of the Greek "nomós")
SMNS	State Museum of Natural History Stuttgart/Germany
SSPC	Personal collection of SPYROS SFENTHOURAKIS

Acknowledgements

The following persons have provided samples of terrestrial isopods from the archipelago of Crete for the present investigation: Drs. P. LYMBERAKIS, M. MYLONAS, K. VARDINOYANNIS (Irákleio/Crete), Mr. M. FAZOS, Mr. Z. TSIRIDANIS and Mr. I. NATHENAS (Hellenic Speleological Society/Crete), Dr. S. ANDREEV (Sofia/Bulgaria), Drs. C. & P. DEELEMAN (Ossendrecht/Netherlands), G. DELMASTRO (Carmagnola/Italy), Dr. H. MALICKY (Lunz am See/Austria), Dr. H. PIEPER (Kiel/Germany), J. SCHÖNFELD (Sinzig/Germany), Dr. S. TAITI (Firenze/Italy). The latter and Dr. F. FERRARA (Firenze/Italy) have made valuable suggestions to improve the manuscript. Dr. K. WOLF-SCHWENNINGER (SMNS) operated the SEM and produced the photographs. We express our thanks to them all for their cooperation. In addition, K. PARAGAMIAN wishes to thank all his colleagues of the Hellenic Speleological Society for their company and help during his cave investigations since 1990.

2 Species accounts

2.1 Annotations

The references below the species name indicate publications that contain records of the species from the treated area. So we do not mention these again under "Records", except for surrounding islands. "Records" include all published records from the Cretan Archipelago and the new material. The names of localities are written according to the standards for conversion of Greek names into the Latin alphabet of the Hellenic Standards Organisation (ELOT).

Fig. 3. *Ligia italica*, live specimen (photograph: K. PARAGAMIAN).

We could not find consistent diagnostic differences between the genera *Cretoniscellus* Vandel, 1958, *Minoscellus* Vandel, 1958 and *Graeconiscus* Strouhal, 1940, so we synonymise *Cretoniscellus* and *Minoscellus* with *Graeconiscus* (compare VANDEL 1958 and STROUHAL 1940). We consider two rows of indivualised tubercles horizontally on the head and longitudinally on the pereion- and pleon-tergites as ground-pattern and synapomorphy of this genus. The rows on the pereion-tergites can be doubled, and those on the posterior pleon-tergites can be reduced. Additionally we include *Haplophthalmus thermophilus* Çağlar, 1948 in *Graeconiscus* because it has the same ground pattern of tuberculation. Future investigations have to clarify whether other species or other genera from other regions should be included in *Graeconiscus*. The definition of many genera in the Haplophthalminae has been based on small differences in the pattern of tuberculation. A sound revision is needed for the whole subfamily.

2.2 Family Ligiidae

Ligia italica Fabricius, 1798

References: LUCAS 1853: 466; MATSAKIS 1972: 85; SCHMALFUSS 1972a: 39, 1975: 31.

Description, figures, bibliography: VANDEL 1960: 122; present paper (Fig. 3).

Material examined: Samples from the coasts of Crete (SMNS) and the surrounding islands (SSPC).

Records: **Crete**: rocky coasts all around the island. – **Avgó Island** (50 km NE Irákleio, SCHMALFUSS 1975). – **Día Island**. – **Pontikonísi Island**. – **Ágria Gramvoúsa Island**. – **Paximádia Islands (east and west)**. – **Gávdos Island**.

Distribution: The species populates rocky sea-shores of the Black Sea, the Mediterranean Sea and the Canary Islands (VANDEL 1960).

2.3 Family Tylidae

Tylos ponticus Grebnicky, 1874

References: SCHMALFUSS 1972a: 39, 1979: 4 (*T. latreillei*).

Systematics: Two species populate the shores of the Mediterranean Sea which, for the time being, should be called *T. ponticus* Grebnicky, 1874 and *T. europaeus* Arcangeli, 1938 (see TAITI & FERRARA 1996: 460). Only recently these two taxa were recognised as separate species, formerly they were both treated as *T. latreillii* Audouin, 1826, whose identity remains dubious.

Description, figures: TAITI & FERRARA 1996: 460.

Bibliography: SCHMALFUSS & VERGARA 2000: 8.

Material examined: Samples from all parts of Crete (SMNS), and from Día Island (1 ♂, 2 ♀♀, leg. SFENTHOURAKIS, 19.–20.XI.1989, SSPC).

Records: **Crete**: sandy beaches. – **Día Island**.

Distribution: Sandy sea-shores of Black Sea, Mediterranean Sea and Atlantic coast of northwestern Africa S to Dakar, Madeira, Canary Islands (SCHMALFUSS & VERGARA 2000).

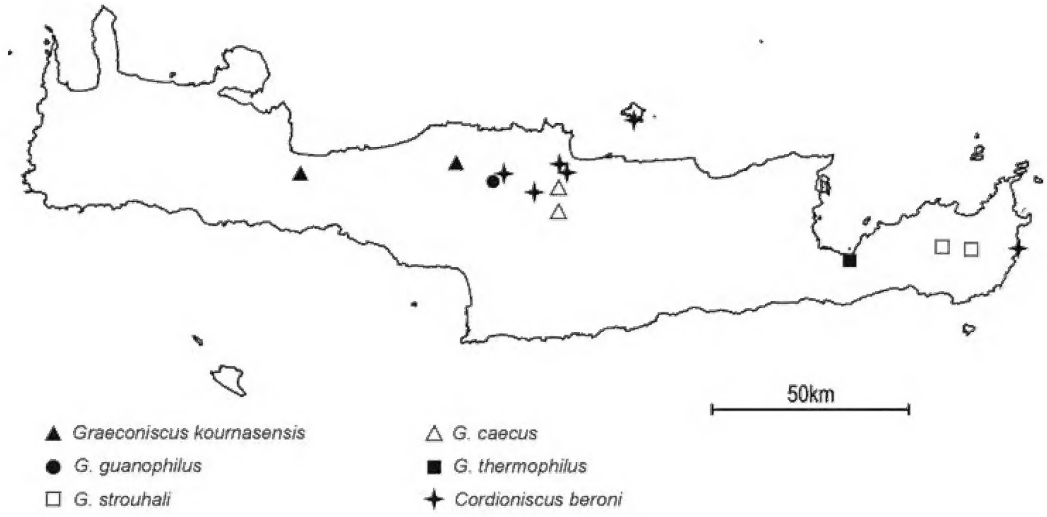


Fig. 4. Cretan records of *Graeconiscus caecus*, *G. guanophilus* n. sp., *G. kournasensis* n. sp., *G. strouhali*, *G. thermophilus* and *Cordioniscus beroni*.

2.4 Family Styloniscidae

Cordioniscus beroni Vandel, 1968

References: Vandel 1968: 622; Dalens 1970: 106; Schmalfuss & Erhard 1998: 4, 9.

Description, figures, bibliography: Schmalfuss & Erhard 1998.

Material examined: 2 ♀♀, pref. Réthymno, Axós, pothole Xepatoménos Táfkos, leg. Paragamian, 25.XI.1995 (KPPC). – 3 ♂♂, 4 ♀♀, pref. Irákleio, Týlissos, cave Sávva Vardáki, leg. Paragamian, 28.X.1992 (KPPC). – 2 ♀♀, pref. Irákleio, Goniés, pothole Lakkí Kodári, leg. Paragamian, 25.XI.1989 (KPPC). – 1 ♀, pref. Lasíthi, Káto Zákros, cave Sta Pelekitá, leg. Paragamian, 9.V.1984 (KPPC).

Records (map Fig. 4): **Crete**: pref. Réthymno: pothole Xepatoménos Táfkos (Axós); pref. Irákleio: cave Kamilári 13 km W Irákleio, cave Sávva Vardáki (Týlissos), pothole Lakkí Kodári (Goniés); pref. Lasíthi: cave Sta Pelekitá (Káto Zákros). – **Día Island**: cave Agrimótrypa (Schmalfuss & Erhard 1998).

Distribution: Known only from the six caves in north-central and eastern Crete and Día Island.

2.5 Family Trichoniscidae

Graeconiscus caecus (Vandel, 1958)

Reference: Vandel 1958: 90 (*Minoscellus c.*).

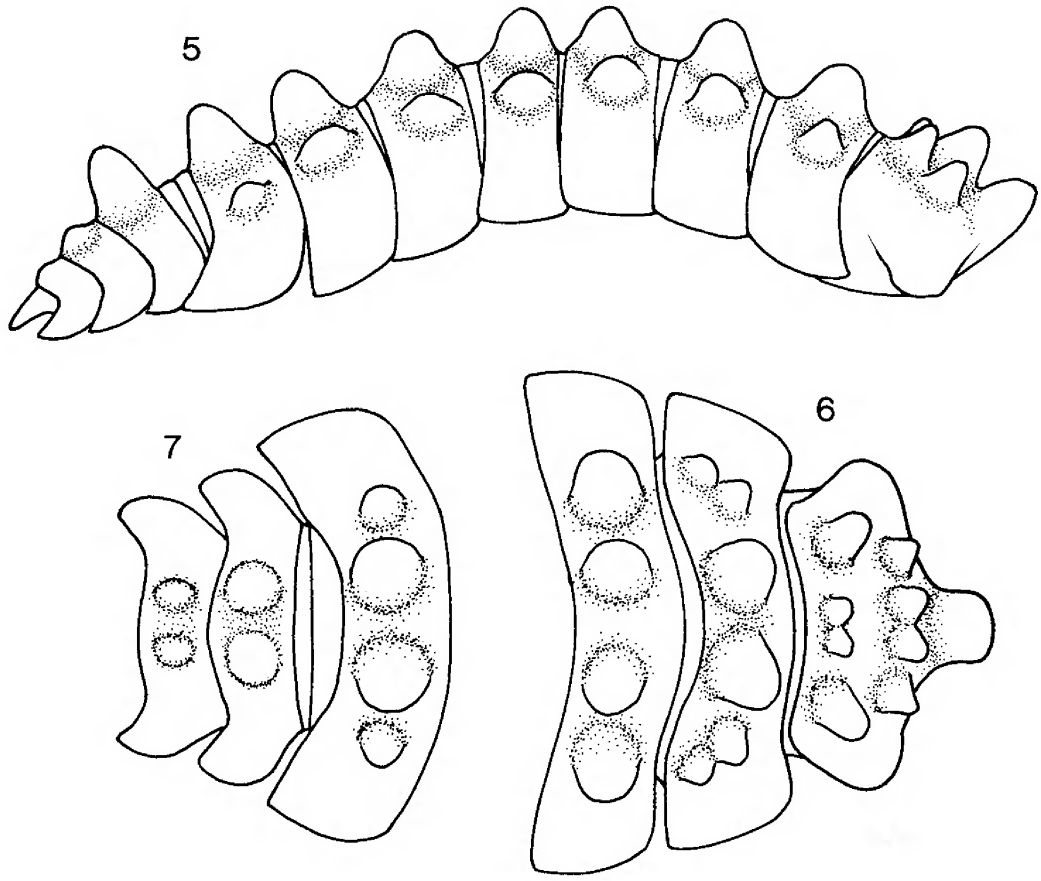
Description, figures: Vandel 1958; present paper (Figs. 5–9).

Material examined: 1 ♂, pref. Irákleio, cave of Sárchos, leg. Paragamian, 30.VI.1991 (SMNS 2307). – 5 ♂♂, 3 ♀♀, pref. Irákleio, Kamaráki, cave Chainóspilio, leg. Paragamian, 4.VIII.1998 (KPPC). – 2 ♂♂, 3 ♀♀, data as before, leg. Paragamian, 3.XI.2003 (SMNS 2784).

Complementary description:

Maximum dimensions: 2.5 mm long (♂ and ♀).

Colouration: White, without any pigmentation.



Figs. 5–7. *Graeconiscus caecus*, ♀ without marsupium, 2.7 mm long (SMNS 2784). – **5.** Lateral view of whole animal, without appendages. **6.** Dorsal view of head and pereion-tergites I and II. **7.** Dorsal view of pereion-tergite VII and pleon-tergites I–IV.

Cuticular structures: Dorsal parts with big individualised tubercles (as in all members of the genus).

Head: With enormous median frontal protuberance, behind this with two rows of four tubercles (Figs. 5–6); without recognisable eyes.

Pereion: Tergites with four strong tubercles, which are equal on tergites II–VI, while on tergites I and VII the medial tubercles are much bigger than the lateral ones (Figs. 5–7).

Pleon: Tergites III and IV with two tubercles each (Figs. 5, 7).

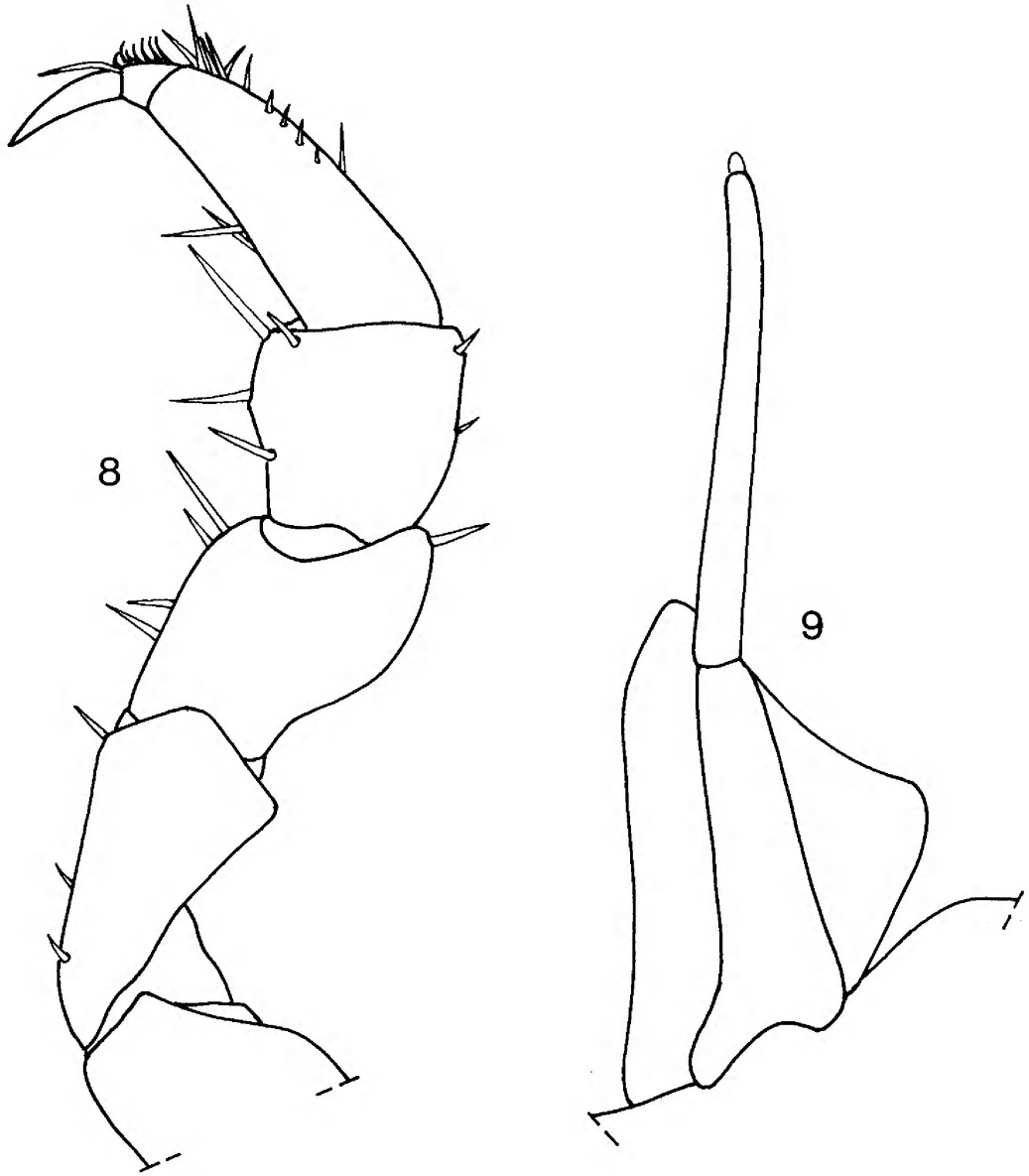
Telson: Trapezoidal as in all Haplophthalminae.

Appendages: ♂ pereiopod VII see Fig. 8, pleopod I see Fig. 9.

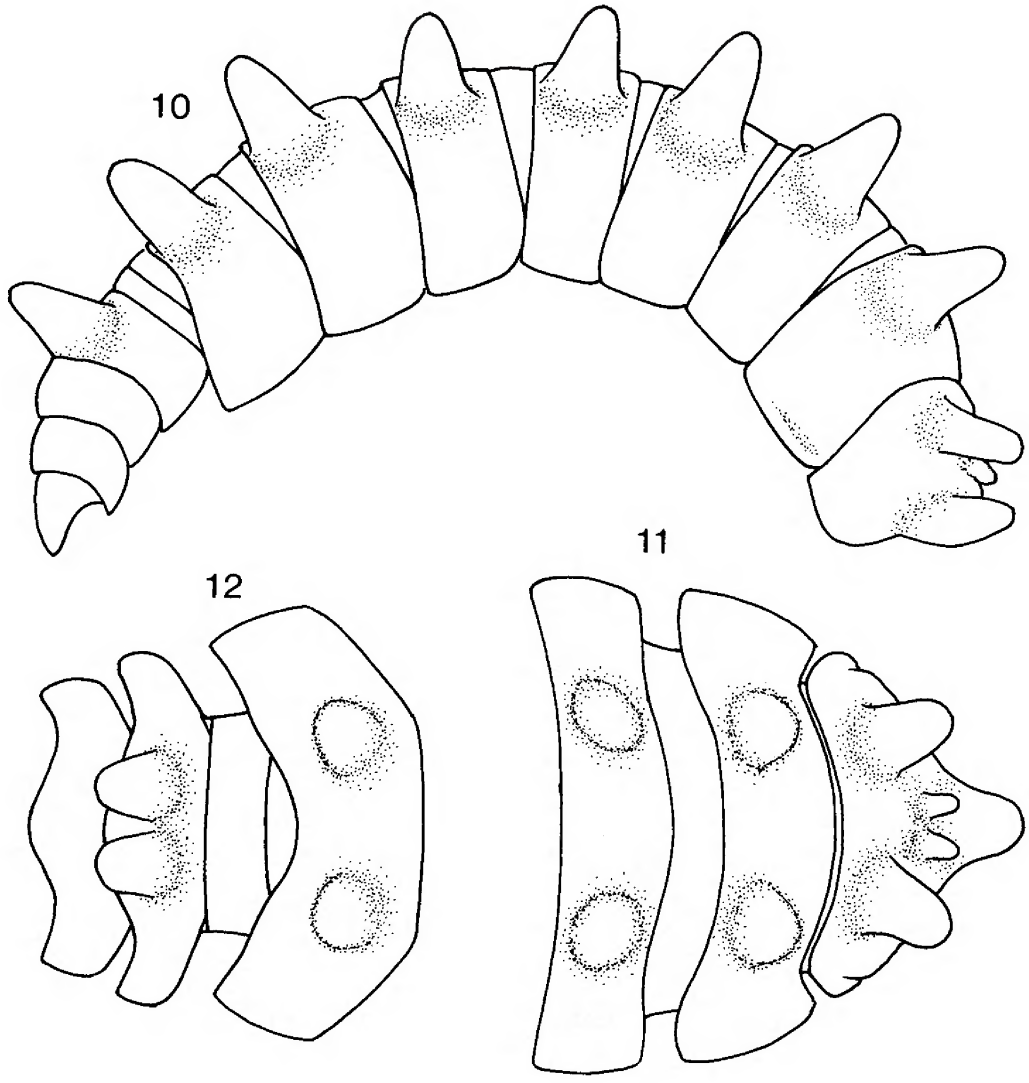
Records (map Fig. 4): **Crete**: pref. Irákleio: cave of Sárchos and cave Chainóspilio.

Distribution: Known only from the two caves on Crete indicated above.

Comments: The species was described as *Minoscellus c.*, we transfer it to the genus *Graeconiscus* Strouhal, 1940 (see chapter 2.1). – The specimen mentioned by Vandel (1958) from Lámia Cave near Margarítes (pref. Réthymno) belongs to *G. kournasensis* n. sp. described below.



Figs. 8–9. *Graeconiscus caecus*, ♂, 2.5 mm long (SMNS 2784). – **8.** Pereiopod VII. **9.** Pleopod I.



Figs. 10–12. *Graeconiscus guanophilus* n. sp. – **10**. Paratype ♂, 2.8 mm long (SMNS T527), lateral view of whole animal, without appendages. **11**. Paratype ♀ without marsupium, 3 mm long (SMNS T527), dorsal view of head and pereion-tergites I and II. **12**. As before, dorsal view of pereion-tergite VII and pleon-tergites I–IV.

Graeconiscus guanophilus n. sp.

Holotype: ♂, 2.7 mm long, pref. Réthymno, W Anógeia, Zonianá, cave Sfendóni, leg. PARAGAMIAN & SCHMALFUSS, 17.IV.2003 (SMNS T526).

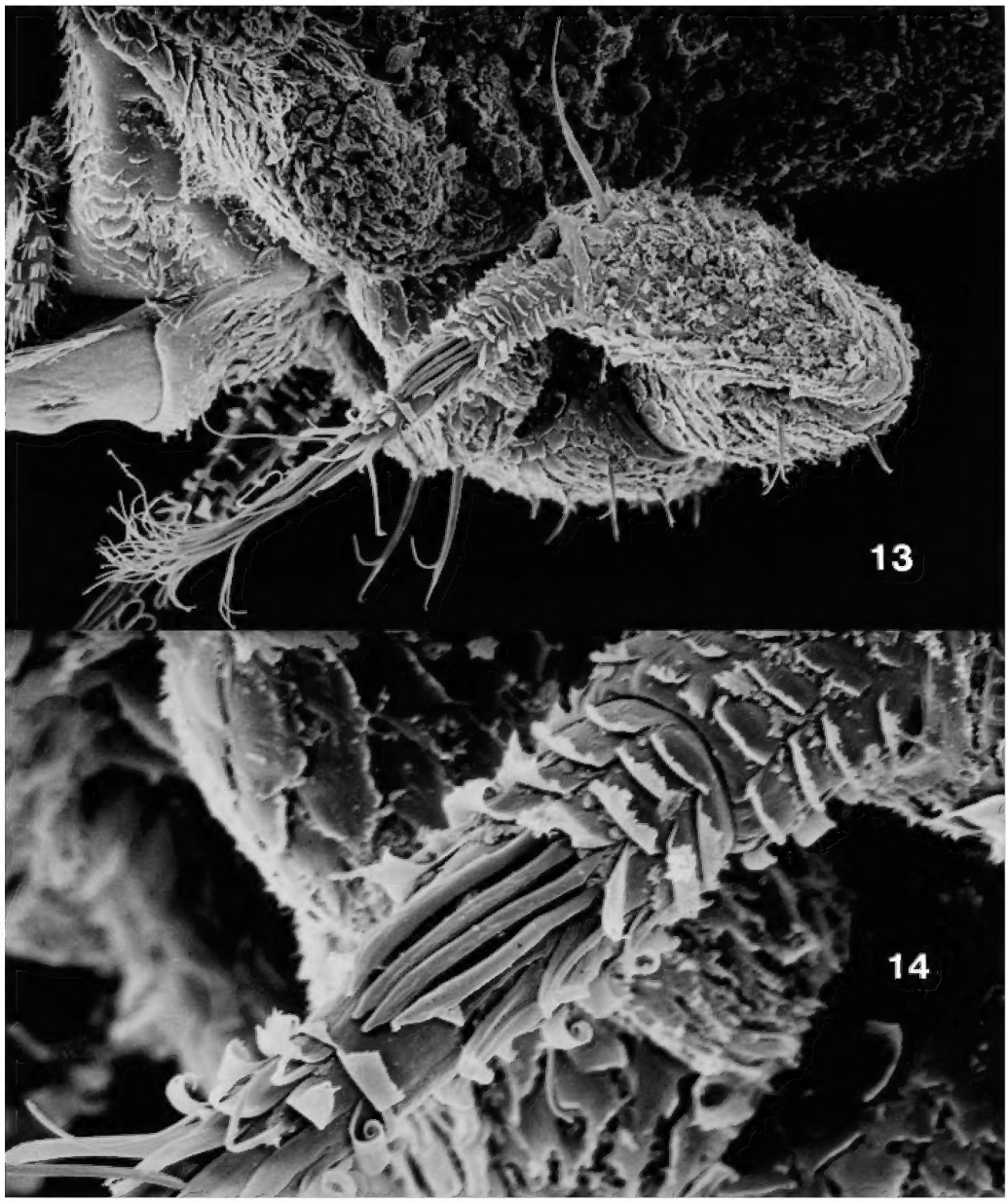
Paratypes: 2 ♂♂, 5 ♀♀, same data as holotype (SMNS T527). – 1 ♂, 1 ♀, same locality, leg. PARAGAMIAN, 25.VI.1995 (NHMC 82.1.5).

Description:

Maximum dimensions: Length 3.0 mm (♀).

Colouration: Without pigmentation, dorsal parts with dirt particles adhering.

Cuticular structures: Dorsal parts with big individualised tubercles.



Figs. 13–14. *Graeconiscus guanophilus* n. sp., paratype ♂, 2.8 mm long (SMNS T527), SEM, critical point preparation. – **13**. Antenna II in situ. **14**. Detail of flagellum of antenna II with aesthetascs.

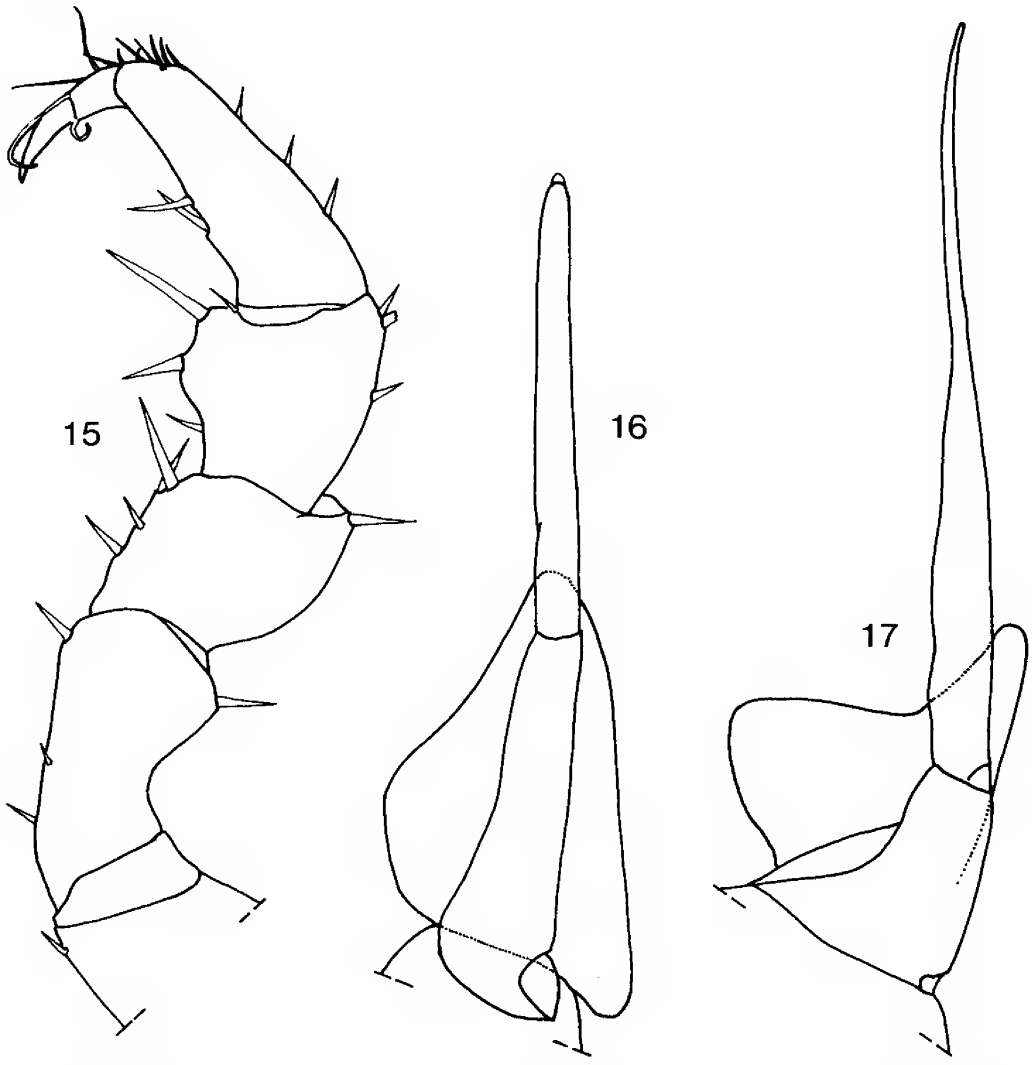
Head: Enormous median frontal protuberance, behind this two small paramedian tubercles, followed by two big lateral tubercles (Figs. 10–11); no eyes recognisable.

Pereion: Only two rows of lateral tubercles on each tergite (Figs. 10–12).

Pleon: With two big paramedian tubercles on tergite III (Figs. 10, 12).

Telson: Trapezoidal as in all Haplophthalminae.

Appendages: Antenna see Figs. 13–14; ♂ pereiopod VII see Fig. 15, ♂ pleopods I and II see Figs. 16–17.



Figs. 15–17. *Graeconiscus guanophilus* n. sp., holotype ♂, 2.7 mm long (SMNS T526). – **15.** Pereiopod VII. **16.** Pleopod I. **17.** Pleopod II.

Differential diagnosis: The species differs from the other Cretan species of the genus by having only two tubercles on each pereion-tergite, and by the pleon bearing two tubercles on tergite III only.

Map with records: Fig. 4.

Graeconiscus kournasensis **n. sp.**

Holotype: ♂, 2.7 mm long, pref. Chaniá, Kournás, cave of Kournás, leg. PARAGAMIAN, 7.XI.1998 (SMNS T530).

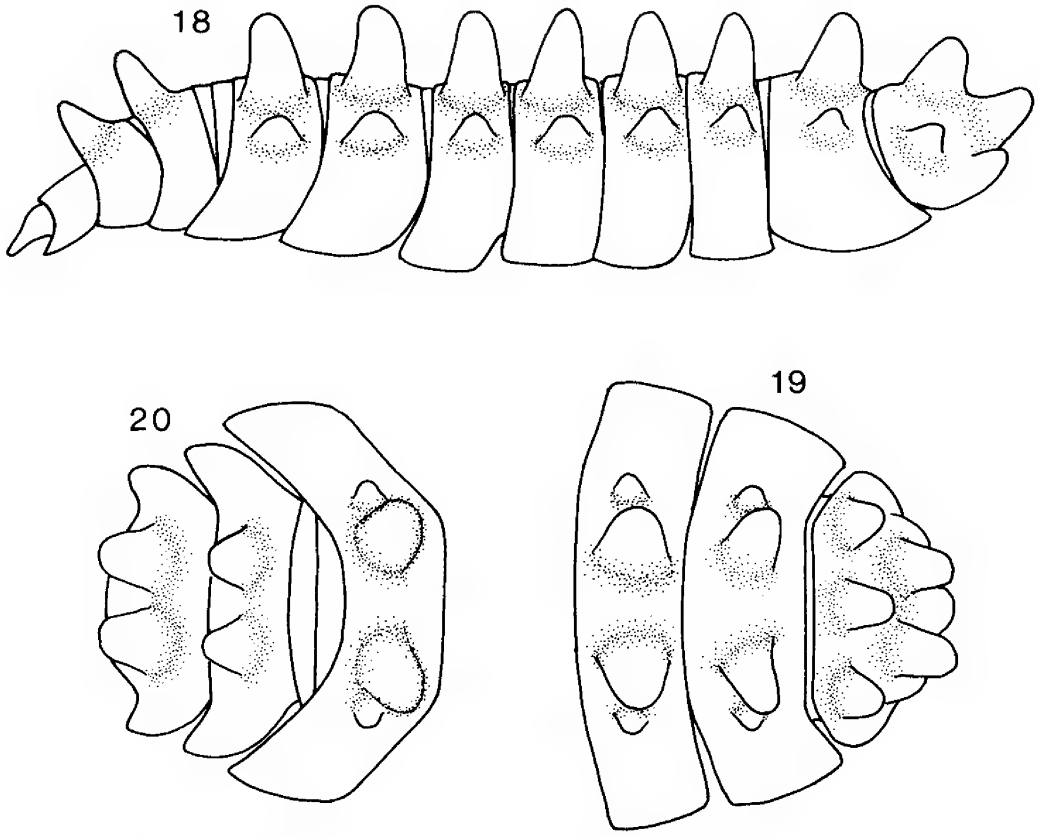
Paratypes: 2 ♂♂, 1 ♀, data as holotype (SMNS T531).

Description:

Maximum dimensions: Length 2.7 mm.

Colouration: Without pigmentation.

Cuticular structures: Dorsal parts with individualised tubercles.



Figs. 18–20. *Graeconiscus kournasensis* n. sp. – **18**. Paratype ♂, 2.7 mm long (SMNS T531), lateral view of whole animal, without appendages. **19**. Holotype ♂, 2.7 mm long (SMNS T530), dorsal view of head and pereion-tergites I and II. **20**. As before, dorsal view of pereion-tergite VII and pleon-tergites I–IV.

Head: No eyes; moderate median frontal protuberance, behind this one row of two and one of three big tubercles (Figs. 18–19).

Pereion: Tergites with two big paramedian and two small lateral tubercles (Figs. 18–20).

Pleon: Tergites III and IV with two big tubercles (Figs. 18, 20).

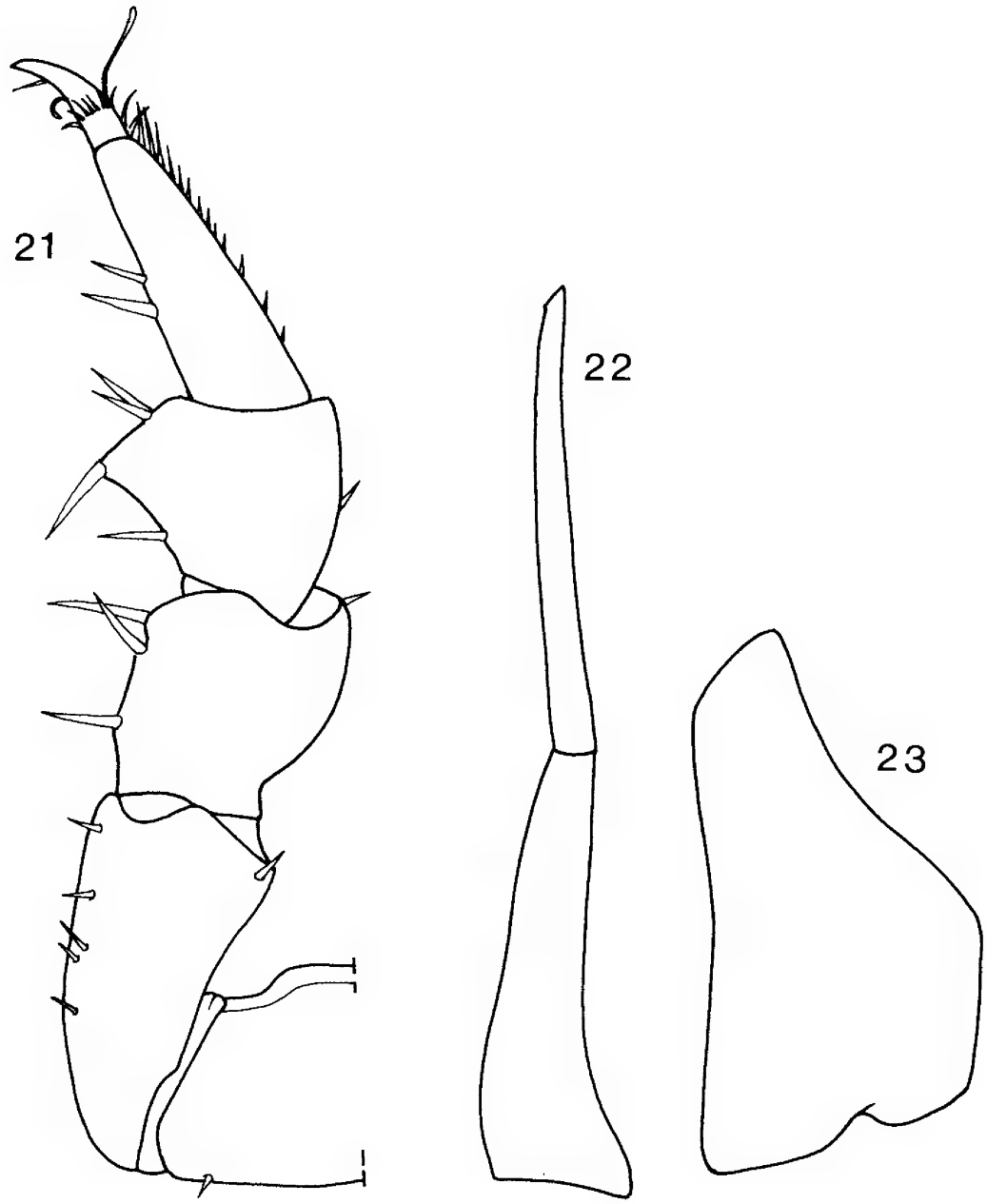
Telson: Trapezoidal.

Appendages: ♂ pereiopod VII see Fig. 21, ♂ pleopod I see Figs. 22–23.

Differential diagnosis: The tuberculation pattern is very similar to the one of *G. caecus*, there are, however, only 5 big tubercles on the head (6 in *G. caecus*) and the proportions of the pereion- and pleon-tubercles are different (compare Figs. 5–7 with Figs. 18–20).

Map with record: Fig. 4.

Comments: The specimen mentioned by VANDEL (1958) from Lámia Cave near Margarítes (pref. Réthymno) as *G. caecus* belongs to this species. It is stored in the Natural History Museum of Paris, where it could be examined by one of the authors of the present paper (S. SFENTHOURAKIS).



Figs. 21–23. *Graeconiscus kournasensis* n. sp., holotype ♂, 2.7 mm long (SMNS T530). – **21**. Pereiopod VII. **22**. Pleopod-endopodite I. **23**. Pleopod-exopodite I.

Graeconiscus strouhali (Vandel, 1958)

Reference: VANDEL 1958: 88 (*Cretoniscellus s.*).

Description, figures: VANDEL 1958.

Material examined: 1 ♂, 1 ♀, pref. Lasíthi, Sítanos, cave Óxo Latsídi, leg. PARAGAMIAN, 6.III.1988 (KPPC).

Records (map Fig. 4): **Crete**: pref. Lasíthi, Ágios Geórgios or Tourtoúloi, cave Megálo Katofýgi, and Sítanos, cave Óxo Latsídi.

Distribution: Known only from the type locality and the above-mentioned cave, both on eastern Crete.

Comments: The species was described as *Cretoniscellus s.*, we transfer it to the genus *Graeconiscus* Strouhal, 1940 (see chapter 2.1).

Graeconiscus thermophilus (Çağlar, 1948)

Synonym: *Calconiscellus aegaeus* Schmalfuss, 1972, **n. syn.**

Reference: Schmalfuss 1972a: 40 (*Calconiscellus aegaeus*).

Description, figures: Strouhal 1963 (*Haplophthalmus t.*); Schmalfuss 1975, 1978 (*Cretoniscellus aegaeus.*).

Records (map Fig. 4): **Crete**: pref. Lasíthi, S Pacheiá Ámmos (SE Ágios Nikólaos).

Distribution: Eastern Crete and southern Aegean islands of Kárpathos (SMNS 1486, Schmalfuss 1999), Mílos, Náxos, Kýthnos, Kálymnos, Kos, Sámos (Sfenthourakis 1994, 1996b) as well as Armutlu (northwestern Asia Minor) on the southeastern shore of the Marmara Sea (Çağlar 1948; Strouhal 1963).

Comments: The species was described as *Haplophthalmus t.* from Asia Minor. *Calconiscellus aegaeus* Schmalfuss, 1972, described from Crete, is herein synonymised with *thermophilus*, and the species is transferred to the genus *Graeconiscus* (see chapter 2.1).

Monocyphoniscus caniensis (Vandel, 1958)

References: Vandel 1958: 85 (*Kosswigius c.*), 1968: 622.

Systematics: Vandel 1968: 622 (change of generic placement).

Description, figures: Vandel 1958.

Material examined: 19 specimens, pref. Chaniá, Élos, spring, leaf litter of *Platanus* and *Castanea*, leg. Schmalfuss, 14.V.2001 (SMNS 2717) and leg. Schmalfuss & Sfenthourakis, 24.IV.2002 (SMNS 2740 and SSPC). – 3 ♀♀, pref. Chaniá, Topólia, cave Agía

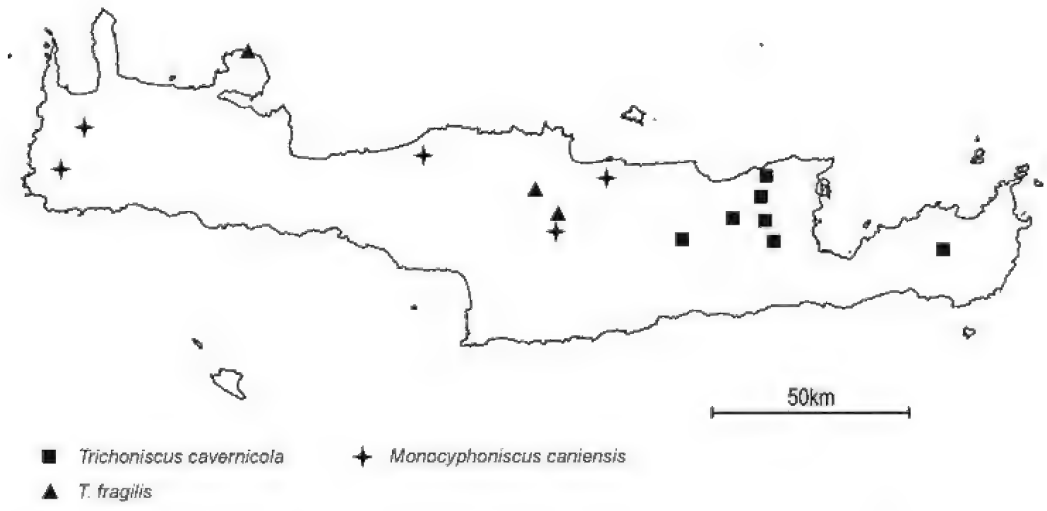


Fig. 24. Cretan records of *Trichoniscus cavernicola*, *T. fragilis* and *Monocyphoniscus caniensis*.

Sofía, leg. PARAGAMIAN, 3.III.1987 (KPPC). – 1 ♀, pref. Réthymno, cave Érfoi, leg. PARAGAMIAN, 2.IX.1995 (KPPC). – 2 ♂♂, 4 ♀♀, pref. Irákleio, Asítes, cave Nychteridóspilios, leg. PARAGAMIAN, 24.II.1998 (KPPC). – 1 ♀, pref. Irákleio, 1 km S of Knosós, river bank, leg. PARAGAMIAN & SCHMALFUSS, 15.IV.2003 (SMNS 2757).

Records (map Fig. 24): **Crete**: pref. Chaniá: cave Agía Sofía, spring of Élos, cave Kalámato (Vafés); pref. Réthymno: cave of Érfoi; pref. Irákleio: cave Nychteridóspilios, river bank S of Knosós.

Distribution: Known from Crete and the islands of Ándros and Antikýthira (SFENTHOURAKIS 1993, 1994).

Trichoniscus cavernicola Vandel, 1958

References: VANDEL 1958: 85 (*T. lindbergi cavernicola*); SCHMALFUSS 1979: 8.

Description, figures: VANDEL 1958 (see also comments below, under *T. lindbergi*).

Material examined: 1 ♂, 1 ♀, pref. Irákleio, Agía Paraskeví, cave Schistá, leg. PARAGAMIAN, 20.IX.1992 (KPPC). – 1 ♂, 1 ♀, pref. Lasíthi, cave of Mílatos, leg. PARAGAMIAN, 11.X.1986 (KPPC). – 2 ♂♂, 2 immatures, pref. Lasíthi, Kritsá, cave Gaidourótrypa, leg. PARAGAMIAN, 29.XI.1992 (KPPC). – 2 specimens, pref. Lasíthi, 13 km S of Neápoli, Adrianoú, cave Atziganóspilios, leg. SCHMALFUSS, 16.IV.2003 (SMNS 2755).

Records (map Fig. 24): **Crete**: pref. Irákleio: cave Schistá (Agía Paraskeví); pref. Lasíthi: cave Peristéra (Vrachási), cave Megálo Katofýgi (Ágios Geórgios or Tourtoúloi), cave of Tzermiádo, cave of Mílatos, cave Gaidourótrypa (Kritsá), cave Atziganóspilios (Adrianoú, 13 km S of Neápoli).

Distribution: This species is known from the above-mentioned caves of eastern and central Crete and from the Aegean islands Ródos (leg. SCHAWALLER, IV.1980, SMNS 1148), Tílos (leg. LIEBEGOTT, V.1983, SMNS 1992), Náxos and Ikaría (ANDREEV 1986).

Trichoniscus fragilis Racovitza, 1908

Reference: VANDEL 1958: 82.

Description, figures: RACOVITZA 1908; VANDEL 1960.

Material examined: 4 ♂♂, 4 ♀♀, pref. Irákleio, Goniés, pothole Póros Stenoú Lagkoú, leg. PARAGAMIAN, 25.XI.1989 (SSPC).

Records (map Fig. 24): **Crete**: pref. Chaniá: cave Achyróspilo (Akrotíri); pref. Irákleio: cave of Sárchos (SW of Irákleio), pothole Póros Stenoú Lagkoú (Goniés).

Distribution: The species has a circum-Mediterranean distribution and is also present at the Atlantic coast of France. It is not restricted to caves (VANDEL 1960; SCHMALFUSS 1979; ANDREEV 1986).

Comments: The samples from Crete were identified by VANDEL (1958) as *T. fragilis*, and he synonymised *T. rhodiensis* Arcangeli, 1934 from Rodos Island doubtfully with this species. In subsequent publications this synonymisation was accepted, but in the recent world catalogue (SCHMALFUSS 2003) *T. rhodiensis* is treated as a separate species. The question should be resolved by detailed investigations and molecular studies.

Trichoniscus lindbergi Vandel, 1958

References: VANDEL 1958: 83–84 (*T. lindbergi lindbergi* and *T. lindbergi intermedius*), 1959: 137, 1968: 622; SCHMALFUSS 1975: 32, 1979: 9 (*T. lindbergi* and *T. intermedius*); ANDREEV 1986: 161.

Description, figures: VANDEL 1958.

Material examined: Many samples from the localities mentioned below (all material, unless otherwise mentioned, in KPPC):

Pref. Chaniá: Thériso gorge (by the river, in the litter layer of *Platanus orientalis*), leg. SCHMALFUSS & SFENTHOURAKIS, 24.IV.2002; Omalós plateau, pothole Tou Tzaní o Spílios, leg. PARAGAMIAN, 10.IX.1988; pothole Arápi Trýpa, leg. PARAGAMIAN, 10.VI.1989; cave of Kournás, leg. PARAGAMIAN, 3.III.1987 (SMNS 2770).

Pref. Réthymno: Anógeia, pothole Táfkos Myristís, leg. PARAGAMIAN, 21.VIII.1992; Kouroútes, pothole Táfkos stin Póde Farágga, leg. PARAGAMIAN, 8.VIII.1992; Así Goniá, pothole Kaoúdi Táfkos, leg. PARAGAMIAN, 20.VIII.1997; Alóides, cave Kouroupitó, leg. PARAGAMIAN, 22.III.1992; Alóides, pothole Táfkos sti Goniá, leg. PARAGAMIAN, 29.III.1992; cave Dalamoúrou, leg. PARAGAMIAN, 27.VI.1993; Axós, pothole Kakalónia, leg. PARAGAMIAN, 9.X.1991; Axós, Katerianá, pothole Katerianós Táfkos, leg. PARAGAMIAN, 6.VII.1992; Potamós Amaríou, cave Stoú Diákoumou ti Ríza, leg. PARAGAMIAN, 30.VII.1997; Anógeia, pothole Táfkos sto Xepatoméno Alóni, leg. PARAGAMIAN, 21.VIII.1992; Anógeia, pothole Xyloúri Táfkos, leg. PARAGAMIAN, 21.VIII.1992; cave of Geráni, leg. PARAGAMIAN, 23.III.1987; Kryonéri, pothole Kryoneríou, leg. PARAGAMIAN, 6.VI.1992; Axós, cave Kamaríti, leg. PARAGAMIAN 7.VI.1992; Kályvos, pothole Stou Táfkou to Lakkí, leg. PARAGAMIAN, 27.VI.1993; Zonianá, cave Sfendóni, leg. PARAGAMIAN, 25.VI.1995 and leg. PARAGAMIAN & SCHMALFUSS, 17.IV.2003 (SMNS 2752).

Pref. Irákleio: Márathos, pothole Megálos Táfkos, leg. PARAGAMIAN, 1.VIII.1992; Márathos, cave Dóxa, leg. PARAGAMIAN, 5.II.1998; Lilianó, pothole Marathólakou, leg. PARAGAMIAN, 4.VII.1993; Týlissos, cave Kamilári, leg. PARAGAMIAN, 9.IV.1998; Kamaráki, cave Chainóspilio and a cave by Chainóspilio, leg. PARAGAMIAN, 4.VIII.1998; Skoteinó, cave Agía Paraskeví, leg. PARAGAMIAN, 3.IV.1987; Goniés, pothole Skararólithos, leg. PARAGAMIAN, 23.VI.1991; Goniés, pothole Lakkí Kontarí, leg. PARAGAMIAN, 25.XI.1989; Goniés, pothole Rikomáschalo, leg. PARAGAMIAN, 11.VI.1989.

Pref. Lasíthi: 7 km N of Makrýgialos, cave Vréiko, leg. SCHMALFUSS, 27.V.2001 (SMNS 2722); Péfkoi N of Makrýgialos, cave Apoloústres, leg. SCHMALFUSS, 26.V.2001 (SMNS 2723).

Records: **Crete**: many caves throughout the island.

Distribution: Known from Crete, from a riparian site (in the litter layer of *Nerium oleander*) at Tínos island (northern Kykládes, SFENTHOURAKIS 1994), and from a cave in central continental Greece (Delfoí, Parnassós Mountain, VANDEL 1959, 1964).

Comments: A form similar to *T. intermedius*, which herein is considered a synonym of *T. lindbergi*, has been found in the litter layer of maquis vegetation at the islet Kandelioússa (Dodekánisos, southeastern Aegean) (SFENTHOURAKIS 1994: 80). SCHMALFUSS (1979) considers also *T. euboensis* Vandel, 1964 from the island of Évvoia (central Aegean) as a synonym of *T. lindbergi*. The taxonomy of this group of species (including *T. cavernicola*) needs further investigation before definite conclusions can be reached. In the present paper we treat these forms as separate species. The distinction is based only on the morphology of ♂ genitalia, since colouration and eye pigmentation vary considerably inside each form.

Trichoniscus sp.

Only ♀ specimens (pigmented, 3 mm long, with marsupium and eggs) from Élos, by a spring in the litter layer of *Platanus orientalis*, leg. SCHMALFUSS & SFEN-

THOURAKIS, 24.IV.2002. They could pertain to *T. lindbergi*, but safe identification is not possible after ♀ specimens.

2.6 Family Detonidae

Armadilloniscus ellipticus (Harger, 1878)

Description, figures, systematics, bibliography: GARTHWAITE et al. 1992.

Material examined (first record from Crete): 3 specimens, pref. Lasíthi, Eloúnta, leg. TAITI, 19.VII.1989 (SMNS 2250).

Records: **Crete**: pref. Lasíthi, Eloúnta N of Ágios Nikólaos.

Distribution: Coasts of the northern Atlantic, the Mediterranean, Madagascar, Hawaii and the western Pacific (TAITI & FERRARA 1996).

2.7 Family Bathytropidae

Bathytropa granulata Aubert & Dollfus, 1890

References: VERHOEFF 1929: 118 (*Labyrinthasius graecus*); VANDEL 1958: 91, 1968: 622; SCHMALFUSS 1972a: 43, 1975: 37.

Description, figures, systematics, bibliography: VANDEL 1962: 548.

Material examined: 2 specimens, pref. Chaniá, Samariá Gorge, leg. PAGET et al., 17.IV.1965 (SMNS 1431). – 1 specimen, pref. Chaniá, Élos, spring, leaf litter of *Platanus* and *Castanea*, leg. SCHMALFUSS, 14.V.2001 (SMNS 2717). – 4 specimens, pref. Irákleio, 1 km S of Knosós, cave entrance, leg. PARAGAMIAN & SCHMALFUSS, 15.IV.2003 (SMNS 2758).

Records: **Crete**: all parts, including several caves. – **Gávdos Island** (SCHMALFUSS 1975).

Distribution: Known from the coasts of the northern Mediterranean (VANDEL 1962: 548; SCHMALFUSS 1975, 1999; CARUSO et al. 1987; CRUZ 1989; SFENTHOURAKIS 1994).

Rodoniscus anophthalmus Arcangeli, 1934

Description, figures: ARCANGELI 1934.

Material examined (first record from the Cretan archipelago): 1 ♂, 2 ♀♀, Día Island, leg. SFENTHOURAKIS, 19.–20.XI.1989 (SSPC).

Records: **Día Island**.

Distribution: This endogean species is known from the southern Aegean islands (SFENTHOURAKIS 1993, 1994, 1996b; SCHMALFUSS 1999).

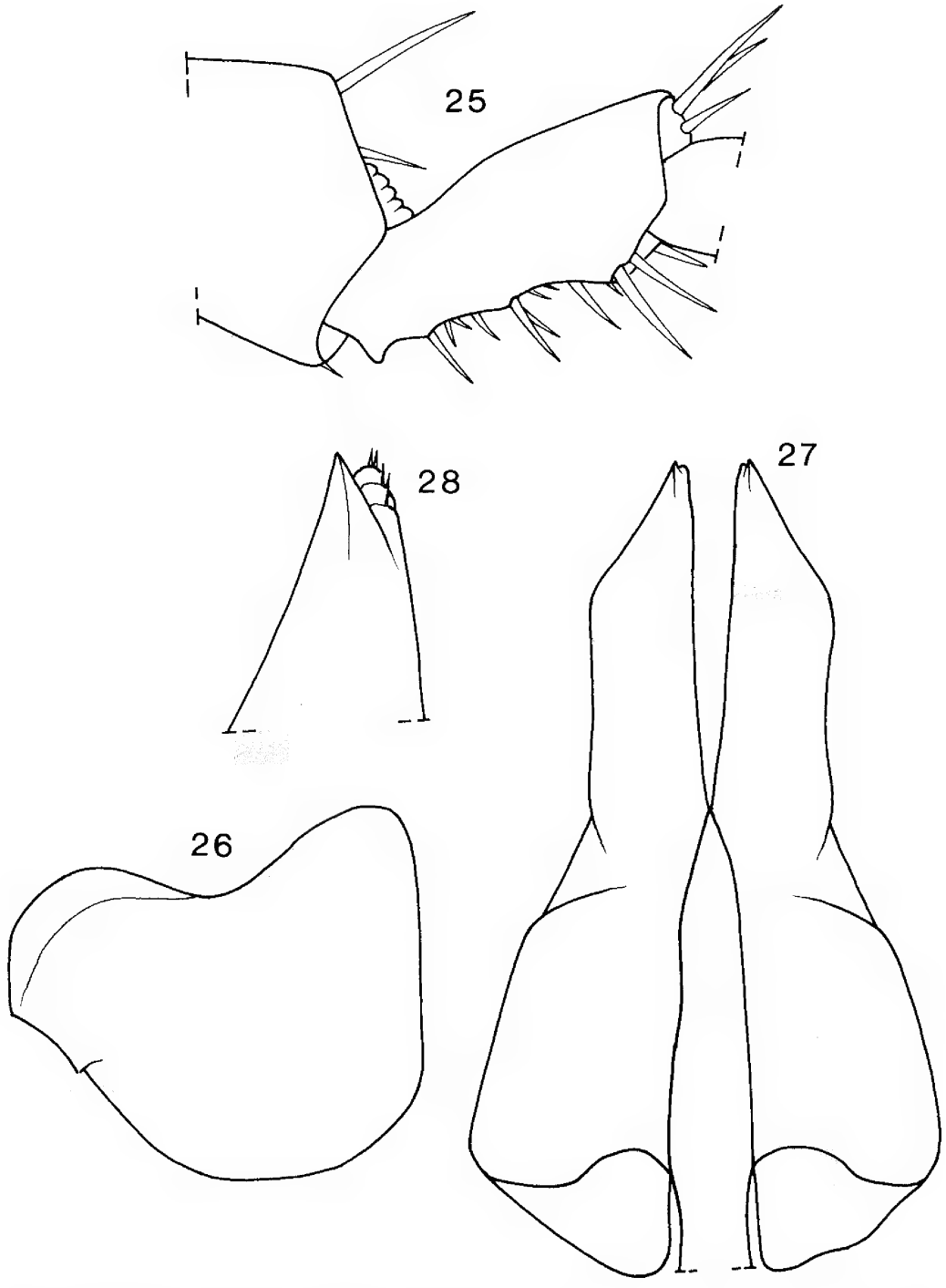
2.8 Family Philosciidae

Chaetophiloscia cellaria (Dollfus, 1884)

References: STROUHAL 1929b: 39 (*Neophiloscia magnopunctata*); VANDEL 1958: 82 (*C. sicula* non Verhoeff); SCHMALFUSS 1972a: 42, 1975: 34 (*C. magnopunctata*), 1979: 13, 1990a: 170.

Description, figures, systematics, bibliography: SCHMALFUSS 1990a.

Material examined: Samples from all parts of the main island, including many caves and potholes, and from several surrounding islands (SMNS, KPPC and SSPC).



Figs. 25–28. *Philoscia univittata*, ♂, 8 mm long, Crete (SMNS 2783). – **25**. Merus of pereiopod VII. **26**. Pleopod-exopodite I. **27**. Pleopod-endopodite I. **28**. Apex of pleopod-endopodite I.

Records: **Crete**: all parts. – **Día Island.** – **Gávdos Island** (SCHMALFUSS 1975). – **Ágria Gramvoúsa Island.** – **Avgó Island** 50 km NE of Irákleio (SCHMALFUSS 1979). – **Paximádia Islands (east and west).**

Distribution: Coastal regions of the northern Mediterranean from Spain to Lebanon (SCHMALFUSS 1991).

Philoscia univittata Strouhal, 1937

Description, figures, systematics, bibliography: SCHMALFUSS 1990b. For diagnostic characters see also present paper (Figs. 25–28).

Material examined (first records from Crete): 5 ♂♂, 3 ♀♀, pref. Chaniá, Élos, spring, leaf litter of *Platanus* and *Castanea*, 500 m, leg. SFENTHOURAKIS, 15.X.2002 (SMNS 2783). – 15 ♀♀, pref. Chaniá, Élos, spring, leg. SCHMALFUSS & SFENTHOURAKIS, 24.IV.2002 (SMNS 2740). – 1 ♀, pref. Chaniá, Kolympári, edge of stream, leg. PAGET et al., 17.IV.1965 (SMNS 1430).

Records (map Fig. 29): **Crete**: the two above mentioned sites in the western part.

Distribution: Transadriatic, known from central Italy, Albania and the south-western Greek mainland (SCHMALFUSS 1990b).

Comments: Figs. 25–28 show merus VII and pleopods I of a ♂ from Crete. We have the suspicion that *P. univittata* may be a synonym of *P. dalmatica*. Pleopod-exopodite I seems to be variable and cannot be used as diagnostic for the species; endopodite I of the Cretan specimens agrees completely with *P. dalmatica* (compare figs. 15–16 in SCHMALFUSS 1990b). The only difference concerns the shape of the basal hook on merus VII, and this may turn out to be inside the variability scope of the species. From a biogeographic view this interpretation would seem much more consistent than the mosaic distribution of the two species *dalmatica* and *univittata*. Further samples from more localities are necessary to clarify the question.

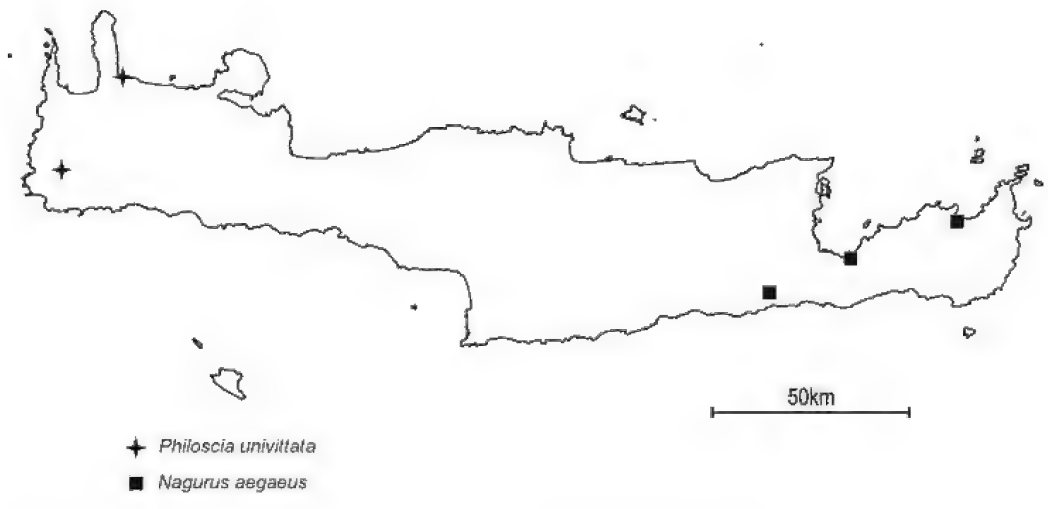


Fig. 29. Cretan records of *Philoscia univittata* and *Nagurus aegaeus*.

2.9 Family Halophilosciidae

Halophiloscia couchii (Kinahan, 1858)

References: Matsakis 1972: 109; Schmalfuss 1972a: 42 (*H. aristotelis*).
Description, figures, systematics, bibliography: Vandel 1962: 477.

Material examined: Samples from all parts of Crete (SMNS) and from Día Island (2 ♂♂, leg. Sfenthourakis, 19.–20.XI.1989, SSPC).

Records: **Crete**: all parts. – **Día Island**.
Distribution: Bermuda (introduced?, Schultz 1972), Macaronesian Islands, Atlantic coasts from Morocco to British Isles, coasts of Mediterranean and Black Sea (Vandel 1962; Karaman 1966; Ferrara & Taiti 1978; Schmalfuss 1979; Harding & Sutton 1985; Caruso et al. 1987; Garcia & Cruz 1996). Introduced to North and South America, Hawaii and Australia; synonymy and bibliography see Schmalfuss 2003).

Halophiloscia hirsuta Verhoeff, 1928

Reference: Schmalfuss 1975: 36.
Description, figures, bibliography: Vandel 1962: 483.

Material examined: 3 ♀♀, Pontikonísi Island, leg. Sfenthourakis, 22.IV.1990 (SSPC).

Records: **Crete**: Georgioúpoli. – **Pontikonísi Island**.
Distribution: Coasts of the northern Mediterranean from Spain to Greece (Vandel 1962; Ferrara & Taiti 1978; Schmalfuss 1979; Caruso et al. 1987; Garcia & Cruz 1996). Introduced to Brazil (Lemos de Castro 1962).

Stenophiloscia vandeli Matsakis, 1967

References: Schmalfuss 1972a: 42 (*S. dalmatica* non Verhoeff, 1930), 1975: 36.
Description, figures: Matsakis 1967; present paper (Figs. 30–31).

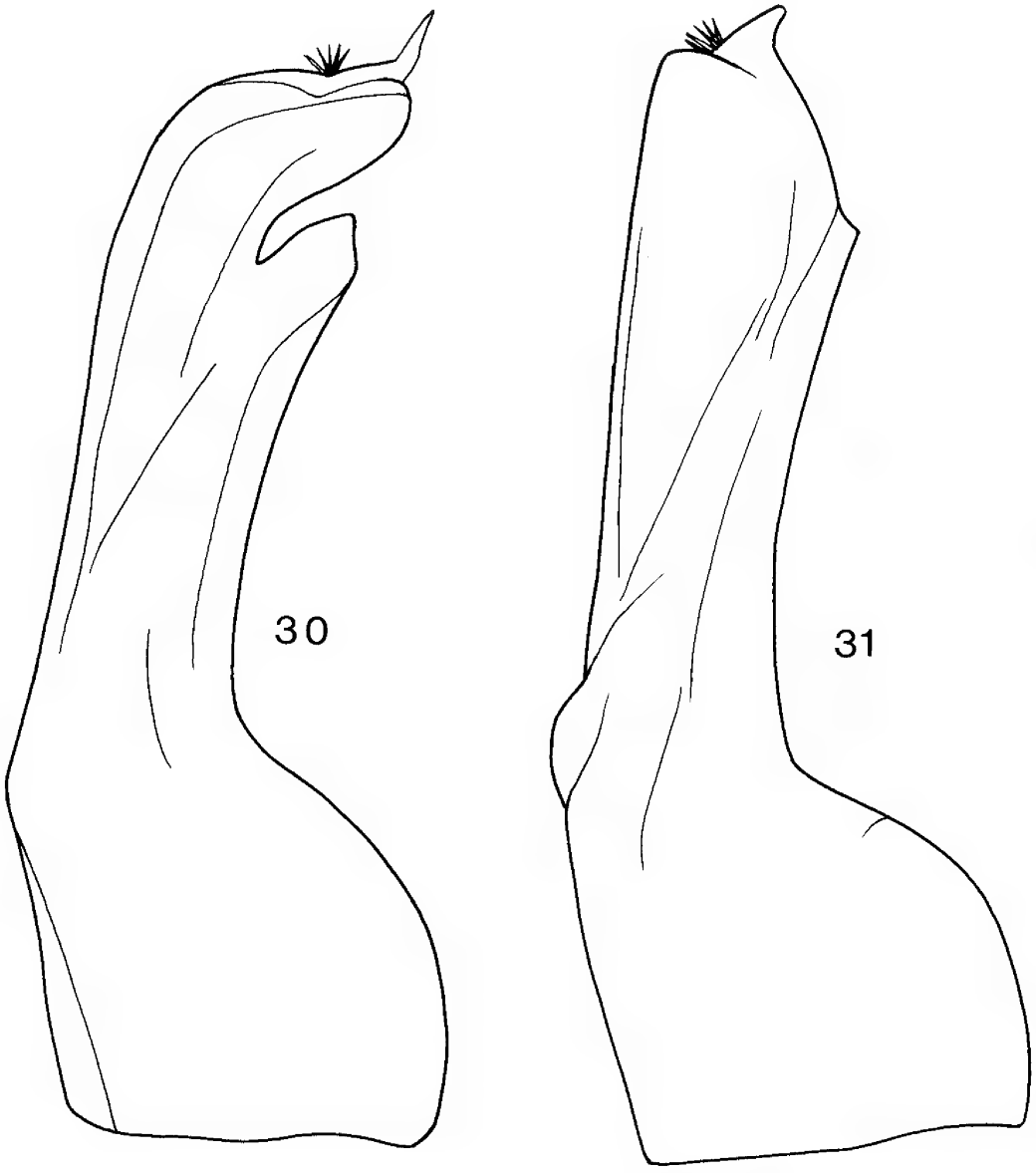
Material examined: 3 ♂♂, pref. Lasíthi, Eloúnta N of Ágios Nikólaos, leg. Taiti, 19.VII.1989 (SMNS 2250). – 12 specimens, pref. Lasíthi, 10 km E Siteía, sandy beach, leg. Schmalfuss, 8.IV.2003 (SMNS 2768). – 1 ♀, Día Island, leg. Sfenthourakis, 19.XI.1989 (SSPC).

Records: **Crete**: several places from the north coast. – **Día Island**.
Distribution: Coasts of the southern Aegean Sea (Schmalfuss 1979, 1999; Sfenthourakis 1994, 1996b).
Comments: The species seems to exhibit two morphological varieties of the ♂ pleopod-endopodite I (Figs. 30–31). Fig. 30 shows the shape depicted in the original description, Fig. 31 could be the same structure in a different stage of the reproductive circle. No other differences between the two ♂ types could be found, and both morphological varieties have been collected under the same stone (compare Schmalfuss & Schawaller 1984).

2.10 Family Trachelipodidae

Nagurus aegaeus Schmalfuss, 1977

References: Schmalfuss 1972a: 49, 1975: 39 (?*Nagurus* spec.).
Description, figures, systematics, bibliography: Schmalfuss 1994: 3.



Figs. 30–31. *Stenophiloscia vandeli.* – **30.** ♂, 3.5 mm long, Santorini Island (SMNS 1945), pleopod-endopodite I. **31.** ♂, 3.9 mm long, Santorini Island (SMNS 1943).

Material examined: 1 ♀, pref. Lasíthi, 15 km west of Ierápetra, Mýthoi Gorge, leg. SCHMALFUSS, 7.IV.2003 (SMNS 2759).

Records (map Fig. 29): **Crete**: pref. Lasíthi: Pacheiá Ámmos, Siteía, Mýthoi Gorge.

Distribution: Known from the Aegean islands Ándros, Tínos, Náxos, Astypálaia, Sýros, Amorgós, Kárpathos and Crete (SCHMALFUSS 1994; SFENTHOURAKIS 1994).

Fig. 32. *Trachelipus cavaticus* n. sp., live specimen (photograph: K. PARAGAMIAN).

Trachelipus cavaticus n. sp.

Holotype: ♂, 13.0 × 8.0 mm, pref. Chaniá, Kournás, cave of Kournás, leg. PARAGAMIAN, 3.III.1987 (SMNS T516).

Paratypes: 6 ♂♂, 3 ♀♀, same data as holotype (SMNS T517: 4 ♂♂, 2 ♀♀; KPPC: 2 ♂♂, 1 ♀). – 1 ♂, 1 immature, pref. Chaniá, Akrotíri peninsula, cave Arkalóspilios, leg. PARAGAMIAN, 23.III.1997 (SMNS T560). – 1 ♂, pref. Chaniá, Lefká Óri, southern flank, 1200 m, leg. LYMBERAKIS, 23.II.1990 (NHMC 82.1.1). – 3 ♀♀, pref. Réthymno, 5 km S of Réthymno, cave Mýloi, leg. PARAGAMIAN, 1.III.1987 (KPPC). – 3 ♀♀, 7 immatures, pref. Réthymno, 10 km W of Réthymno, cave of Geráni, leg. PARAGAMIAN, 23.III.1987 (SMNS T520). – 2 ♀♀, pref. Réthymno, Elénes Amaríou, cave of Marilé Trýpa, leg. PARAGAMIAN, 18.I.1998 (KPPC). – 1 ♂, 1 ♀, pref. Réthymno, Así Goniá, cave of Afroimoú, leg. PARAGAMIAN, 14.VI.1997 (NHMC 82.1.2). – 1 ♀, 5 immatures, pref. Réthymno, Zourída Gorge, cave Piratoú, leg. TSIRIDANIS, 23.III.1997 (SMNS T561). – 1 ♂, 1 ♀, pref. Réthymno, 5 km SW Réthymno, Prínes, artificial cave, leg. PAGET et al., 26.IV.1965 (SMNS T518). – 3 ♂♂, 2 immatures, pref. Réthymno, Alykés, cave Simonéli, leg. PARAGAMIAN, 28.V.1995 (SMNS T562).

Description (live specimen see Fig. 32):

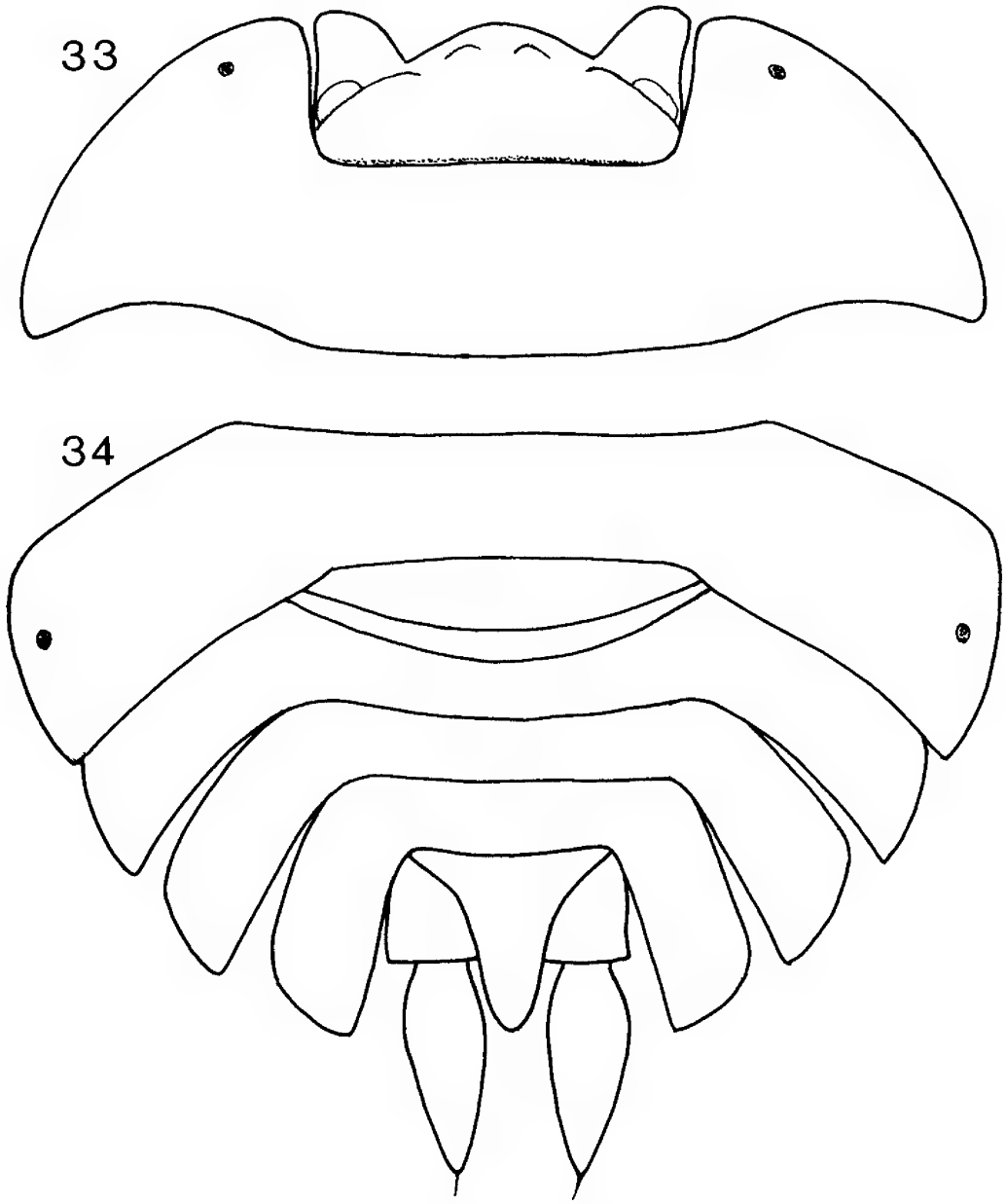
With all synapomorphic characters of the genus *Trachelipus* (clinger type, tergites tuberculated, nodulus lateralis I in more medial position than II-VII, distinct roundish fields of gland pores on pereion-epimera, first epimera posteriorly concave, antennal flagellum two-jointed, ♂ carpus VII with dorsal crest, setal fields distally on ischium VII and proximally on merus VII, all pleopod-exopodites with open respiratory fields, ♂ exopodite I with a horn-like caudal process).

Maximum dimensions: ♀ 15.0 × 9.3 mm, ♂ 13.5 × 8.3 mm.

Colouration: Light brownish of variable intensity.

Cuticular structures: Tubercles on tergites are less pronounced than in the sympatric epigean *T. kytherensis.*

Head: Lateral margins of head parallel (converging backwards in *T. kytherensis*). Median lobe evenly rounded (forming a rounded angle in *T. kytherensis*) (Fig. 33). Eyes of adult specimens with ± 12 ommatidia (± 20 in *T. kytherensis*).



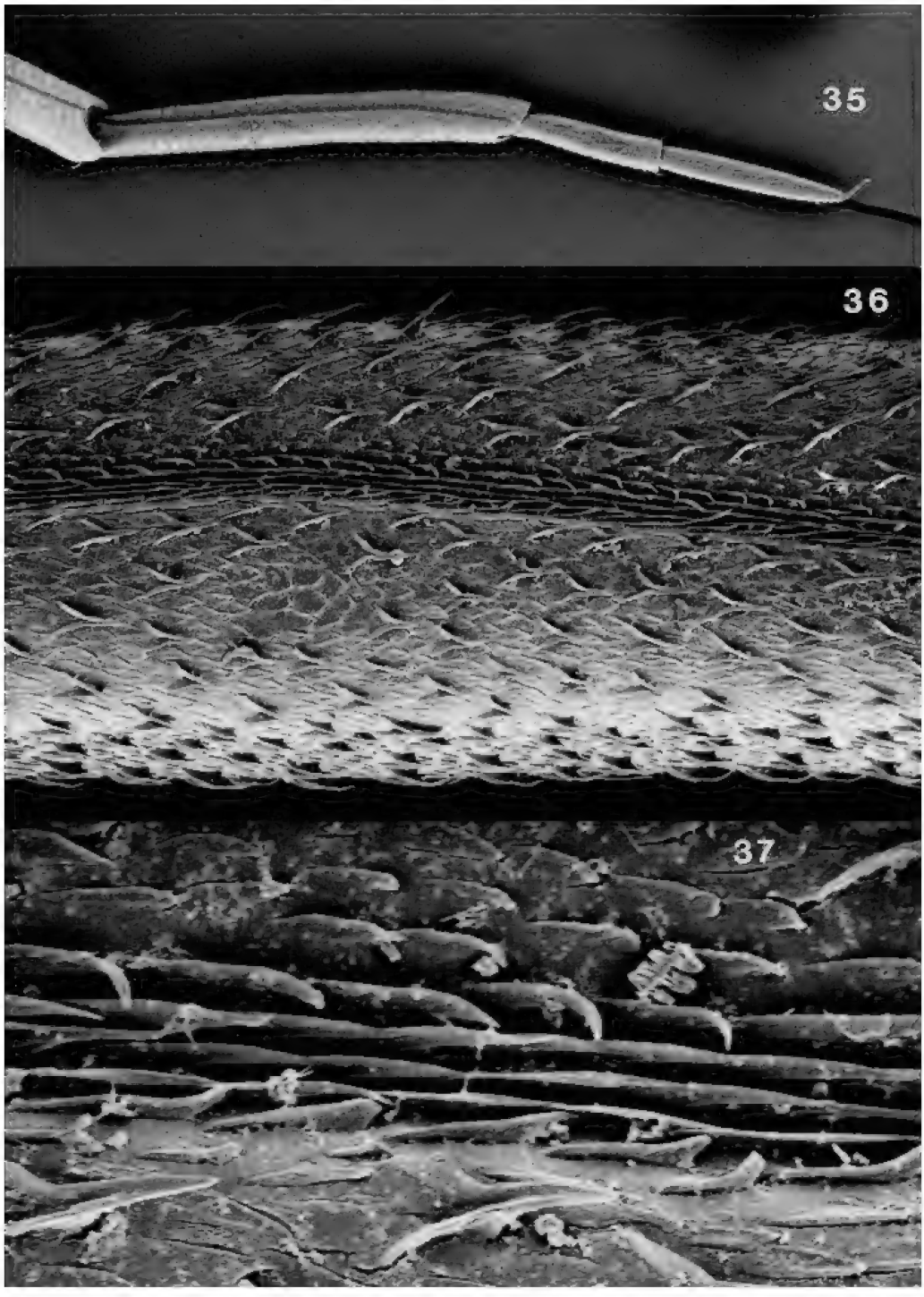
Figs. 33–34. *Trachelipus cavaticus* n. sp., holotype ♂, 13 × 8 mm (SMNS T516). – **33.** Head and pereion-tergite I, dorsal view. **34.** Pereion-tergite VII and pleon, dorsal view.

Pereion: Epimera wider and flatter than in *T. kytherensis*, length/width index 10/6, in *T. kytherensis* 10/5. Pore fields about twice their diameter from lateral margin (Figs. 33–34).

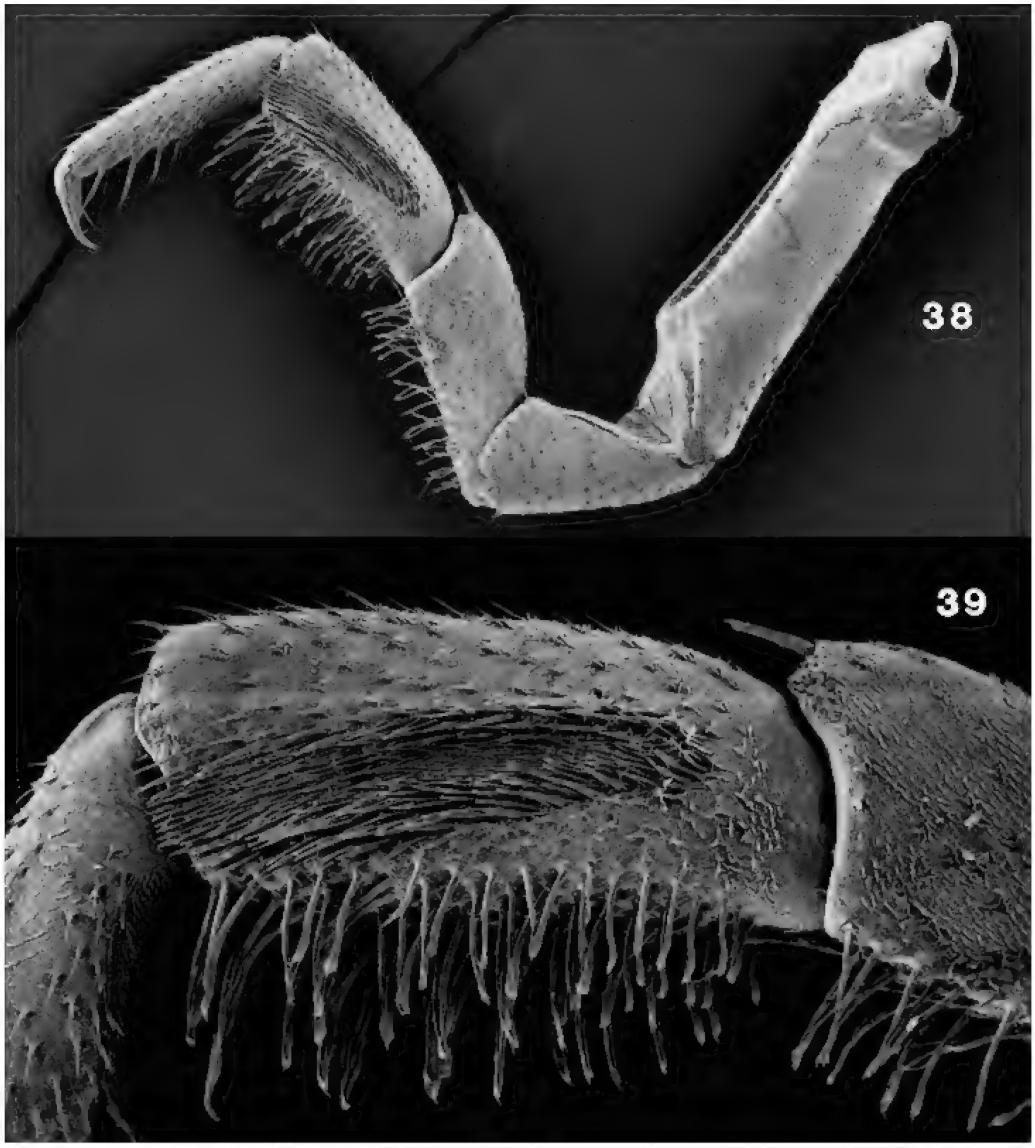
Pleon: Epimera longer than in *T. kytherensis* (Fig. 34).

Telson narrower and longer than in *T. kytherensis* (Fig. 34).

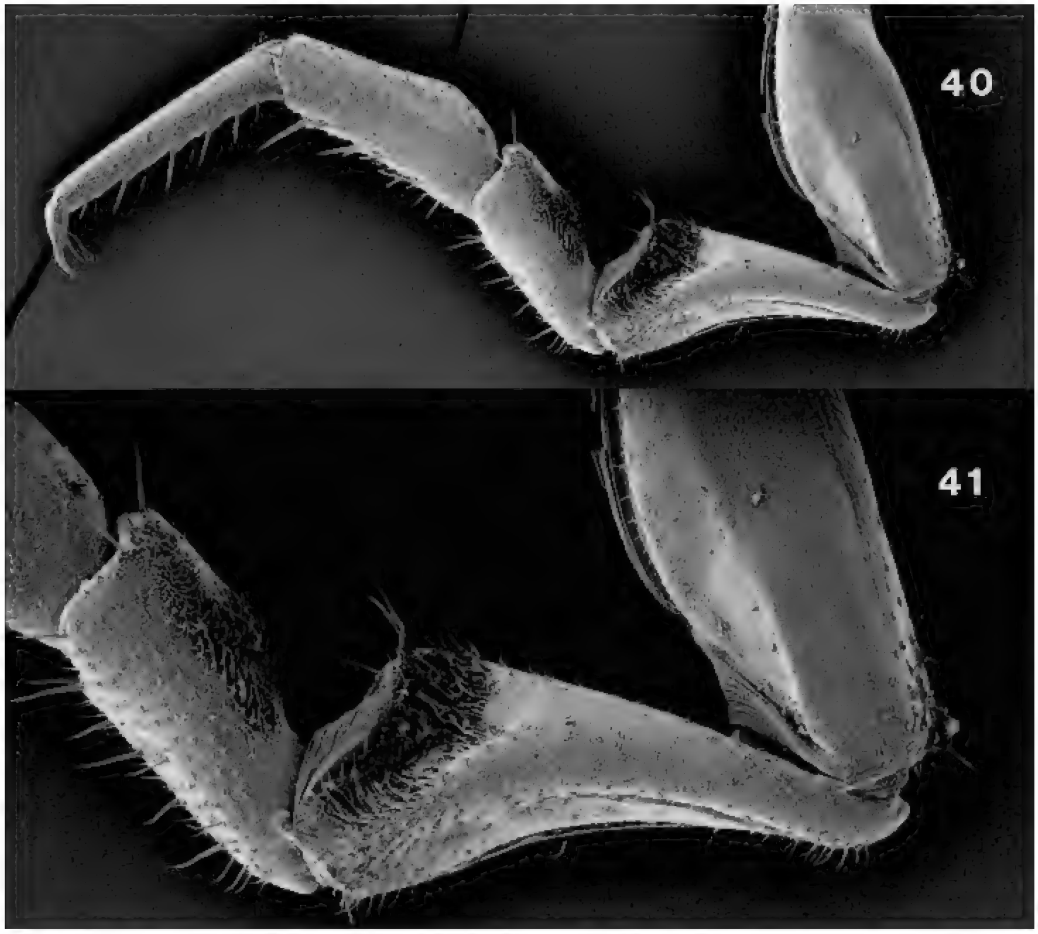
All appendages are longer and frailer than in *T. kytherensis.* Antenna see Figs. 35–37; ♂ carpus I with smaller crest than in *T. kytherensis* (Figs. 38–39); pereio-



Figs. 35–37. *Trachelipus cavaticus* n. sp., holotype ♂, 13 × 8 mm (SMNS T516), SEM, air-dried. – **35.** Antenna II. **36.** Water-conducting groove on distal joint of peduncle. **37.** Close-up of water conducting groove.



Figs. 38–39. *Trachelipus cavaticus* n. sp., holotype ♂, 13 × 8 mm (SMNS T516), SEM, air-dried. – **38**. Pereiopod I. **39**. Carpus of pereiopod I with antennal grooming apparatus.



Figs. 40–41. *Trachelipus cavaticus* n. sp., holotype ♂, 13 × 8 mm (SMNS T516), SEM, air-dried. – **40**. Pereiopod VII. **41**. Close-up of merus and ischium with setal fields used in copulation behavior.

pod VII see Figs. 40–41; ♂ pleopod-exopodite I differing in shape from *T. kytherensis* (see Figs. 42–43); uropods see Fig. 34.

Comments: Most of the differences towards *T. kytherensis* can be interpreted as adaptation to life in caves. The differences are constant and no transitional characters are observed in the two species; the drawings and photographs are made from syntopical specimens of both species from the lake of Kournás. This has lead us to consider the cave populations a different new species.

Map with records: Fig. 44.

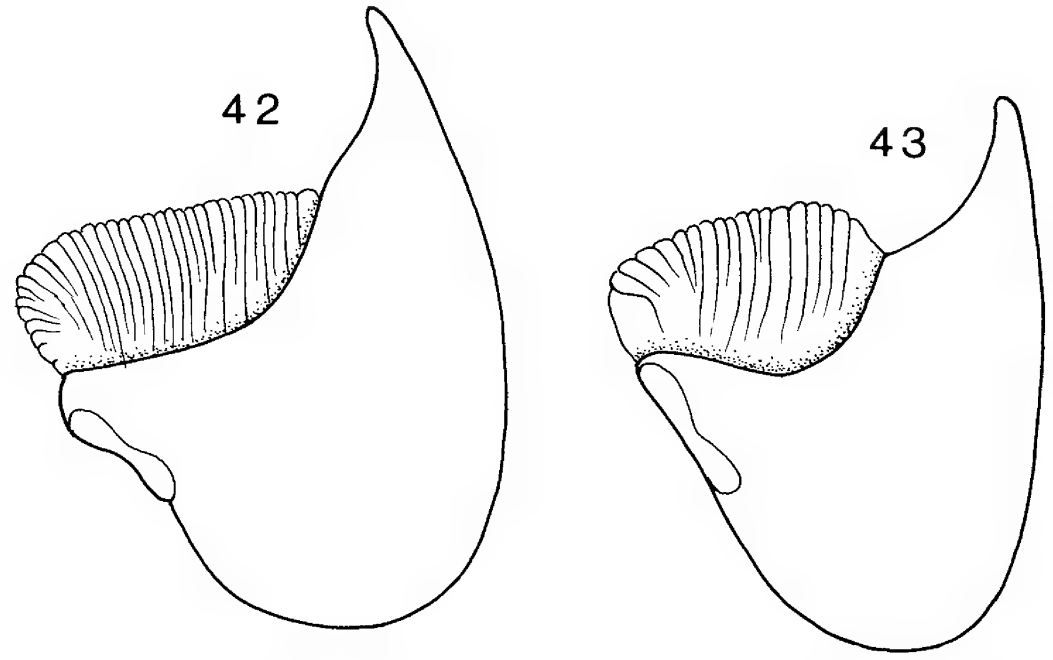
Trachelipus kytherensis (Strouhal, 1929)

Synonym: *Tracheoniscus palustris* Strouhal, 1936 (compare Schmalfuss 2003).

References: Vandel 1958: 82 (*T. graecus*); Schmalfuss 1972a: 49 (*T. graecus*).

Description, figures: Strouhal 1929b (*Tracheoniscus k.*), 1936 (*Tracheoniscus palustris*); Schmidt 1997: 176 (*T. palustris*); present paper (Figs. 43, 45–50).

Systematics, bibliography: Schmalfuss 1979: 34, 2003: 297.



Figs. 42–43. Pleopod-exopodite I. – **42**. *Trachelipus cavaticus* n. sp., holotype ♂, 13 × 8 mm (SMNS T516). **43**. *Trachelipus kytherensis*, ♂, 12 × 6 mm, Lake of Kournás (SMNS 2187).

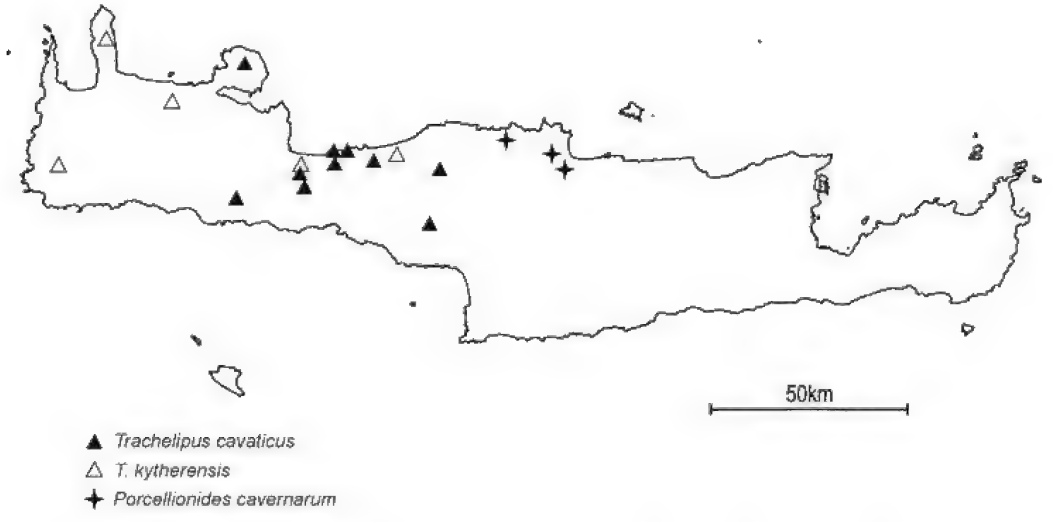
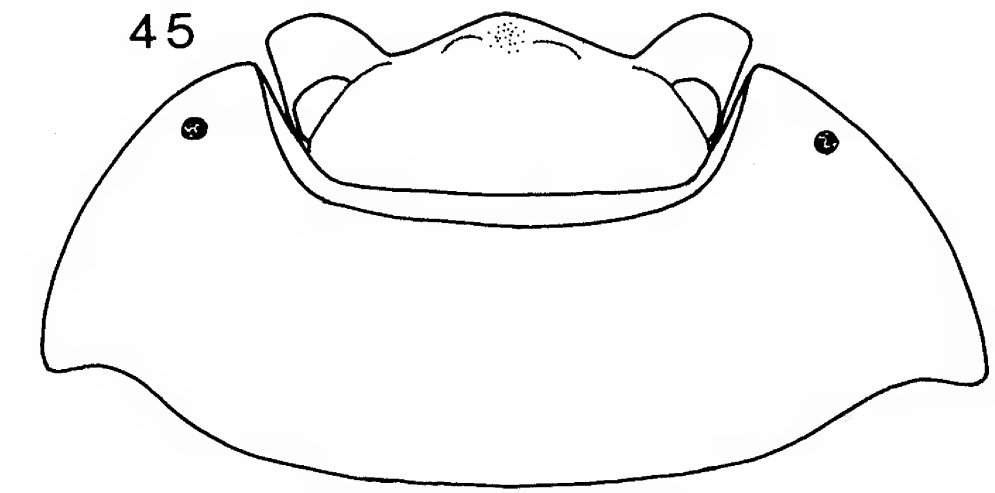
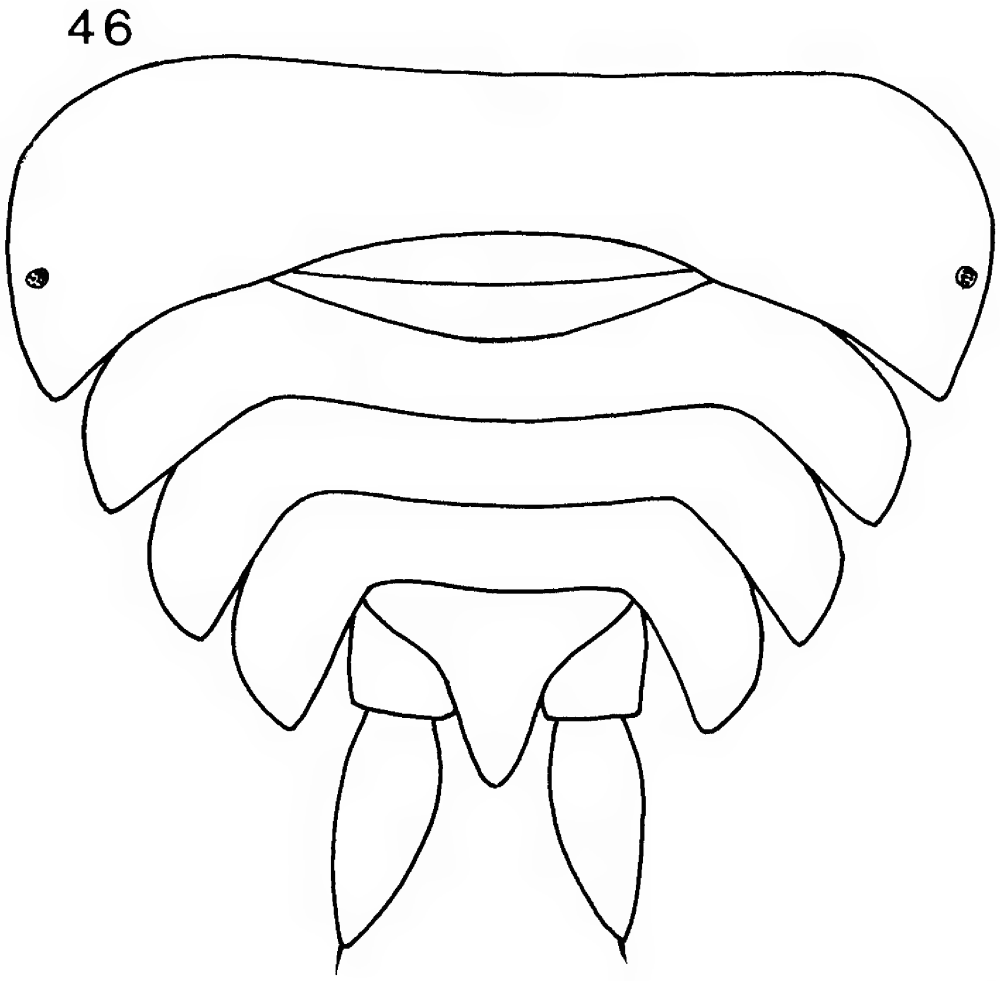


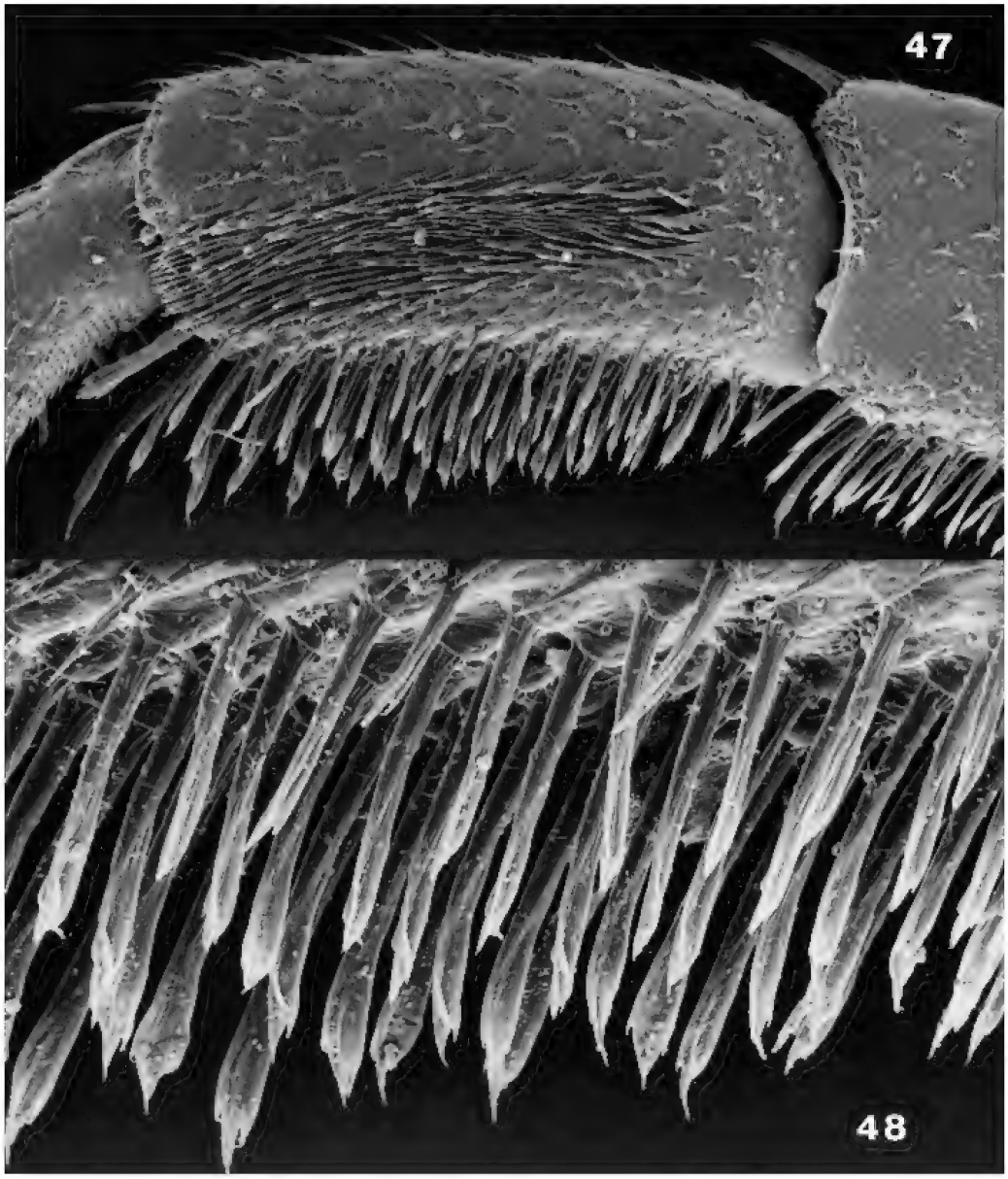
Fig. 44. Cretan records of *Trachelipus cavaticus* n. sp., *T. kytherensis* and *Porcellionides cavernarum*.

Material examined: 2 specimens, pref. Chaniá, lake of Kournás, leg. Fiechtner, 13.IX.1988 (SMNS 2187). – 1 ♀, pref. Chaniá, Skinés 12 km SW of Chaniá, leg. Malicky, 18.XII.1981 (SMNS 2051). – 4 immatures, pref. Chaniá, Élos, leg. Malicky, 20.II.1982 (SMNS 2057). – 40 specimens, pref. Chaniá, Élos, spring, leaf litter of *Platanus* and *Castanea*, leg. Schmalfuss & Sfenthourakis, 14.V.2001 and 24.IV.2002 (SMNS 2717 and 2740). – 11 ♂♂, 4 ♀♀, 2 immatures, pref. Chaniá, Afráta, cave Folí, leg. Paragamian, 4.III.1995 (KPPC). – 3 ♂♂, 4 ♀♀, 17 immatures, pref. Réthymno, Maroulás, cave Nychteridóspilios, leg. Paragamian, 14.V.1995 (KPPC).





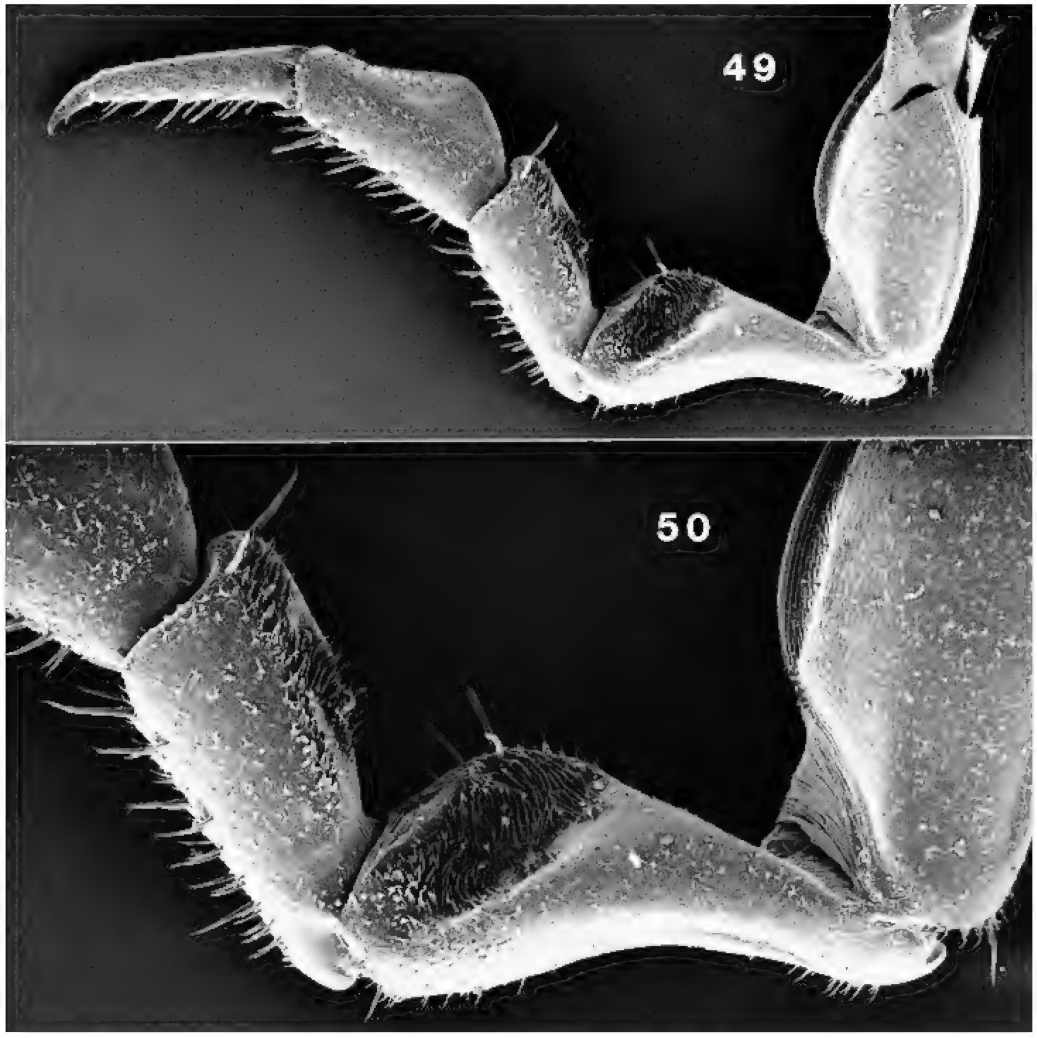
Figs. 45–46. *Trachelipus kytherensis*, ♂, 12 × 6 mm, Lake of Kournás (SMNS 2187). – **45.** Head and pereion-tergite I, dorsal view. **46.** Pereion-tergite VII and pleon, dorsal view.



Figs. 47–48. *Trachelipus kytherensis*, ♂, 12 × 6 mm, Lake of Kournás (SMNS 2187), SEM, air-dried. – **47**. Carpus of pereiopod I with antennal grooming apparatus. **48**. Detail of ventral brush of spines.

Records (map Fig. 44): **Crete**: pref. Chaniá; pref. Réthymno: cave Nychteridóspilios (Maroulás).

Distribution: Northwestern and central Greece, Peloponnese, island Kýthira, western Crete (SCHMALFUSS 1979).



Figs. 49–50. *Trachelipus kytherensis*, ♂, 12 × 6 mm, Lake of Kournás (SMNS 2187), SEM, air-dried. – **49**. Pereiopod VII. **50**. Close-up of merus and ischium with setal fields used in copulation behavior.

2.11 Family Agnaridae

Orthometopon phaleronense (Verhoeff, 1901)

References: Strouhal 1929a: 85, 1937b: 128; Schmalfuss 1972a: 46, 1975: 39, 1993: 22.

Description, figures, systematics, bibliography: Schmalfuss 1993: 22.

Material examined: Many samples from all parts of Crete (SMNS, SSPC, NHMC) and from Gávdos Island (NHMC).

Records: **Crete**: all parts. – **Gávdos Island**.

Distribution: Greece: Northern Sporádes, Évvoia, Attikí, western Kykládes, central and western Crete (Schmalfuss 1993: map fig. 2).

2.12 Family Platyarthridae

Platyarthrus beieri Strouhal, 1954

Description, figures: STROUHAL 1954; SFENTHOURAKIS 1994.

Systematics: May be conspecific with *P. kislarensis* reported from southwestern Turkey (VERHOEFF 1941) and the Lebanon (VANDEL 1955). It is, however, certainly not the same species as *P. messorum* Verhoeff, 1936 from Bulgaria, of which we have examined the type specimens (National Museum of Natural History Sofia).

Material examined (first record from Crete): 1 ♀, pref. Réthymno, Moní Arkadíou, leg. SCHÖNFELD, 7.X.1999 (SMNS 2687).

Records: **Crete**: western Crete, but certainly overlooked in other parts of the island.

Distribution: Greece, known from the Ionian Islands, the Peloponnese, and the Cyclades Islands (SCHMALFUSS 1979, 1999; SFENTHOURAKIS 1994).

Platyarthrus lindbergi Vandel, 1959

Description, figures: VANDEL 1959; SFENTHOURAKIS 1994.

Material examined (first records from Crete): 2 ♂♂, 2 ♀♀, pref. Chaniá, Lefká Óri, above Vrýses, 1400 m, leg. SFENTHOURAKIS, 23.IV.2002 (SSPC). – 1 ♀, pref. Réthymno, Mount Pseilorítis, above Anógeia, 1200 m, leg. SFENTHOURAKIS, 25.IV.2002 (SSPC).

Records: **Crete**: probably present throughout the island, in ant-nests.

Distribution: Known from northern and central continental Greece (VANDEL 1959) and from many Aegean islands (SFENTHOURAKIS 1994).

Platyarthrus schoeblii Budde-Lund, 1885

References: SCHMALFUSS 1972a: 43, 1979: 18.

Description, figures, bibliography: VANDEL 1962; SCHMALFUSS 1979; SFENTHOURAKIS 1994.

Material examined: Samples from many parts of Crete up to 1000 m (SMNS, NHMC) and from Ágria Gramvoúsa Island (3 specimens, leg. SFENTHOURAKIS, 23.IV.1990, SSPC).

Records: **Crete**: all parts up to 1000 m. – **Ágria Gramvoúsa Island**.

Distribution: Mediterranean coasts and Canary Islands (VANDEL 1962; SCHMALFUSS 1979, 1999; SFENTHOURAKIS 1994).

2.13 Family Porcellionidae

Agabiformius lentus (Budde-Lund, 1885)

References: STROUHAL 1937a: 221 (*Porcellio l.*); non SCHMALFUSS 1972a: 44; SCHMALFUSS 1975: 40 (partim).

Description, figures, bibliography: STROUHAL 1937a; VANDEL 1962; STROUHAL 1968.

Material examined: Samples from all parts of Crete up to 1200 m (SMNS, SSPC, NHMC).

Records: **Crete**: all parts up to 1200 m. – **Gávdos Island** (SCHMALFUSS 1975).

Distribution: Originally on Mediterranean coasts, by human activities introduced to many other parts of the world (VANDEL 1962; KARAMAN 1966; STROUHAL

1968; SCHMALFUSS 1979; SFENTHOURAKIS 1994; GARCIA & CRUZ 1996; LEISTIKOW & WÄGELE 1999).

Agabiformius obtusus (Budde-Lund, 1909)

Description, figures, bibliography: STROUHAL 1965, 1968; CRUZ 1994.

Material examined (first records from Crete): 1 ♂, pref. Chaniá, Kastélli, leg. SCHÖNFELD, 6.X.1999 (SMNS 2689). – 14 specimens, pref. Lasíthi, 10 km E Siteía, beach, leg. REISE & SCHMALFUSS, 18.III.1970 (SMNS 1230, 1241). – 1 ♂, pref. Lasíthi, 10 km E Siteía, beach, leg. SCHMALFUSS, 8.IV.2003 (SMNS 2768). – 5 specimens, pref. Lasíthi, beach E Siteía, leg. PIEPER & SCHMALFUSS, 8.IV.1982 (SMNS 1911). – 7 specimens, pref. Lasíthi, E of Ierápetra, 11 km E of Makrýgialos, beach, leg. SCHMALFUSS, 7.IV.2003 (SMNS 2769). – 3 specimens, Gávdos Island, leg. PIEPER, 20.III.1971 (SMNS 1640).

Records: **Crete**: besides the above mentioned samples, the species is probably present everywhere on sandy beaches. – **Gávdos Island**.

Distribution: Coasts of the Mediterranean, also Sudan and Kuwait (STROUHAL 1965, 1968; SCHMALFUSS 1979, 1999; SFENTHOURAKIS 1994; GARCIA & CRUZ 1996).

Leptotrichus naupliensis (Verhoeff, 1901)

References: BUDDE-LUND 1896: 41 (*P. panzerii* non Audouin); SCHMALFUSS 1972a: 44 (*P. panzerii* non Audouin), 1975: 41, 2000a: 17.

Description, figures, bibliography: SCHMALFUSS 2000a: 7, 17.

Material examined: Samples from all parts of Crete up to 1000 m (SMNS, SSPC).

Records: **Crete**: all parts up to 1000 m.

Distribution: Coastal regions of eastern Mediterranean (from Sicily eastward), also in Iraq (SCHMALFUSS 2000a: maps figs. 26–27).

Porcellio flavomarginatus Lucas, 1853

References: LUCAS 1853: 467; CECCONI 1895: 190; STROUHAL 1929b: 39, 48 (*P. creticus*), 51 (*P. decorus*); VANDEL 1958: 82; SCHMALFUSS 1972a: 47, 48 (*P. f.* and *P. decorus*), 1975: 46 (*P. f.* and *P. decorus*), 1979: 21, 23 (*P. f.* and *P. messenicus*).

Description, figures: STROUHAL 1929b: 39, 48, 51 (*P. creticus* and *P. decorus*).

Material examined: Samples from all parts of Crete (SMNS, SSPC, NHMC).

Records: **Crete**: all parts. – **Gávdos Island** (SCHMALFUSS 1975).

Distribution: Central and southern Aegean islands and southwestern Asia Minor (Marmaris N of Ródos Island, SMNS 11544, leg. SCHÖNFELD, X.2002).

Comments: After the original description of *P. flavomarginatus* Lucas, 1853 from Crete two similar species (*P. creticus* and *P. decorus*) were described from Crete by STROUHAL (1929b). *P. creticus* was synonymised by STROUHAL (1937c: 3) with *P. flavomarginatus*. SCHMALFUSS (1979: 23) synonymised *P. decorus* Strouhal, 1929 with *P. messenicus* Verhoeff, 1907 which has been described from the southern Peloponnese. After the examination of hundreds of specimens from Crete and comparisons with *P. flavomarginatus* from other Aegean islands and with *P. messenicus* from the Peloponnese we arrive at the conclusion that all material from Crete belongs to the species *P. flavomarginatus*. This means we synonymise *P. decorus* with *flavomarginatus*. The species exhibits remarkable morphological variation all over its range, and may be considered a superspecies. The specimens from high altitudes

(> 1500 m) differ from those of lower elevations in that they have smooth tergites and darker colouration. Further study is needed before we can definitively conclude if this is due to special adaptations to altitude, or if these two forms are different species.

Porcellio laevis (Latreille, 1804)

References: STROUHAL 1929b: 48; SCHMALFUSS 1972a: 49, 1975: 48, 1979: 22.

Description, figures, bibliography: VANDEL 1962: 684; STROUHAL 1968; SCHMALFUSS 1992.

Material examined: Samples from all parts of Crete (SMNS, SSPC, NHMC).

Records: **Crete**: all parts up to 1200 m. – **Gávdos Island** (SCHMALFUSS 1975).

Distribution: The species has originated in the western Mediterranean and has been introduced to anthropogenous biotopes all over the world (VANDEL 1962; SCHMALFUSS 1992; LEISTIKOW & WÄGELE 1999).

Porcellio lamellatus Budde-Lund, 1885

Reference: SCHMALFUSS 1972a: 47.

Description, figures, bibliography: VANDEL 1962: 741; STROUHAL 1966.

Material examined: 5 specimens, pref. Chaniá, Elafónisos, beach, leg. SCHMALFUSS, 25.IV.2002 (SMNS 2730). – 1 ♀, Ágria Gramvoúsa Island, leg. SFENTHOURAKIS, 23.IV.1990 (SSPC).

Records: **Crete**: pref. Chaniá: Elafónisos; pref. Irákleio: E of Irákleio; probably everywhere on sandy beaches. – **Ágria Gramvoúsa Island**.

Distribution: Coasts of the Mediterranean and the Black Sea, Atlantic Islands, introduced to other parts of the world (VANDEL 1962; STROUHAL 1966; SCHMALFUSS 1979; SFENTHOURAKIS 1994).

Porcellio obsoletus Budde-Lund, 1885

References: BUDDE-LUND 1896: 40; STROUHAL 1929a: 8; SCHMALFUSS 1975: 49.

Description, figures, bibliography: SCHMALFUSS 1992.

Material examined: 5 specimens, pref. Chaniá, Georgioúpoli, 20 m, leg. SCHMALFUSS, 16.V.2001 (SMNS 2718). – 1 ♀, pref. Chaniá, Kolympári, 50 m, leg. SCHMALFUSS, 12.V.2001 (SMNS 2719). – 1 ♀, pref. Réthymno, NW of Mount Psiloreítis, Amnátos, 300 m, leg. MALICKY, 21.IV.1971 (SMNS 1268). – 1 ♀, pref. Lasíthi, Thrýpti Mountains, E Ágios Ioánnis, 500 m, leg. MALICKY, 25.II.1982 (SMNS 2049).

Records: **Crete**: all parts up to around 1600 m.

Distribution: Northeastern Mediterranean with disjunct (?) areas on the Crimea and in the Elburs Mountains (N-Iran) (SCHMALFUSS 1992: maps figs. 55, 65).

Porcellionides cavernarum (Vandel, 1958)

Reference: VANDEL 1958: 92 (*Metoponorthus delattini cavernarum*).

Description: VANDEL 1958; this paper.

Figures: This paper (Figs. 51–54).

Systematics: VANDEL (1958) has described the Cretan *cavernarum* as a subspecies of *delattini* Verhoeff, 1941 from southwestern Turkey (Burdur). Probably

Fig. 51. *Porcellionides cavernarum*, live specimen (photograph: K. PARAGAMIAN).

the similarity of the two forms is due to convergence, so *cavernarum* is better considered a separate species.

Material examined: 1 ♂, 1 ♀, pref. Réthymno, cave of Melidóni, leg. P. DEELEMAN, 6.II. and 16.IV.1981 (SMNS 2142, 2256). – 12 specimens, pref. Réthymno, Síses, cave Moúgkri, leg. PARAGAMIAN, 16.II.1996, 10.VII.1996 and 15.IX.1998 (KPPC and SMNS 2785). – 3 ♂♂, 3 ♀♀, pref. Irákleio, Márathos, cave Dóxa, leg. PARAGAMIAN, 5.II.1998 (KPPC).

Complementary description:

Maximum dimensions: 12.0 × 6.4 mm.

Colouration: White, except for the eyes completely without pigmentation.

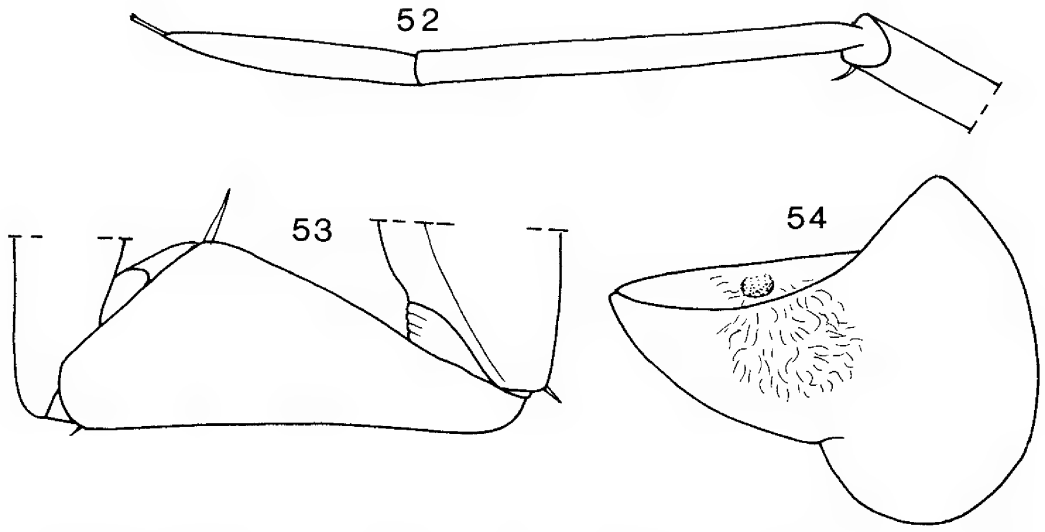
Cuticular structures: Very slightly tuberculated.

Head: Triangular side-lobes separated by very obtuse angle from flat middle lobe. Pigmented eyes with around 8 ommatidia.

Pereion: Epimeron I with slightly excavated or straight hind-margin, epimera II–VII with concave hind-margins.

Appendages extremely long and frail, compared with the epigean species of the genus (antenna see Fig. 52, ♂ ischium VII see Fig. 53, ♂ pleopod-exopodite I see Fig. 54).

Differential diagnosis: The species differs from the other species of the genus by the length/width index (much wider than other species) and the slightly concave hind-margin of pereion-epimeron I (which is a consequence of width increase), by the much longer antennae and pereiopods and by the complete absence of pigmentation.



Figs. 52–54. *Porcellionides cavernarum*, ♂, 12 mm long (SMNS 2785). – **52**. Antennal flagellum. **53**. Ischium of pereiopod VII. **54**. Pleopod-exopodite I.

Records (map Fig. 44): **Crete**: pref. Réthymno: cave of Melidóni, cave Moúgkri (Síses); pref. Irákleio: cave Kamilári (12km W of Irákleio), cave Dóxa (Márathos).

Distribution: Known only from the above mentioned caves of central Crete.

Porcellionides myrmecophilus (Stein, 1859)

References: Strouhal 1929b: 48 (*Porcellio m.*); Schmalfuss 1972a: 45, 1975: 42, 1979: 25.

Description, figures, bibliography: Vandel 1962: 623 (*Metoponorthus m.*).

Records: **Crete**: found in most parts; present all over the island in and around ant-nests in sandy soils.

Distribution: Mediterranean region, also Romania (Vandel 1962).

Comments: Sfenthourakis (1994) considers *P. myrmecophilus* as a variety of the highly polymorphic (super-)species *P. pruinosus*, because in many cases intermediate forms have been found. The taxonomy of this group needs further investigation.

Porcellionides pruinosus (Brandt, 1833)

References: Strouhal 1929b: 45, 1936: 167, 1937a: 219 (*Porcellio p.*); Schmalfuss 1972a: 44, 1975: 43, 1979: 27.

Description, figures, bibliography: Vandel 1962: 618 (*Metoponorthus p.*).

Material examined: Samples from all parts of Crete (SMNS, SSPC, NHMC) and from several surrounding islands.

Records: **Crete**: all parts. – **Ágria Gramvoúsa Island**. – **Pontikonísi Island**. – **Gávdos Island** (Schmalfuss 1975).

Distribution: Originally Mediterranean, synanthropically cosmopolitan.

Proporcellio quadriseriatus Verhoeff, 1917

Systematics: Schmalfuss & Schawaller 1984; Taiti et al. 2000.

Description, figures, bibliography: Strouhal 1937a (*Porcellio melius*); Vandel 1955.

Material examined (first records from Crete): 1 ♂, pref. Chaniá, Falásarna, leg. Sfenthourakis, 24.IV.1990 (SSPC). – 1 ♂, 3 ♀♀, Día Island, leg. Sfenthourakis, 20.XI.1989 (SSPC).

Records: **Crete**: western part. – **Día Island.**

Distribution: Southern Italy, Sicily and island Pantelleria; Greece: Aegean islands; Lebanon; Israel; Libya (Schmalfuss 1979; Sfenthourakis 1994; Taiti et al. 2000).

2.14 Family Armadillidiidae

Armadillidium bicurvatum Verhoeff, 1901

References: Strouhal 1929b: 39, 59 (*A. schulzi*); Schmalfuss 1972a: 51 (*A. schulzi*), 1985: 290.

Description, figures: Schmalfuss 1981: 279.

Systematics: Schmalfuss 1985: 290.

Material examined: 2 ♂♂, 4 ♀♀, pref. Chaniá, Sfinári coast, leg. Vardinoyiannis, 25.II.1991 (SSPC). – 1 ♂, pref. Chaniá, Falásarna, leg. Sfenthourakis, 24.IV.1990 (SSPC). – 1 immature, pref. Chaniá, lake Kournás, leg. Malicky, 17.II.1984 (SMNS 2053).

Records (map Fig. 55): **Crete**: western part.

Distribution: Western Greece from western Makedonía to western Crete (Schmalfuss 1985, map fig. 12).

Armadillidium granulatum Brandt, 1833

References: Lucas 1853: 467; Cecconi 1895: 189; Strouhal 1929a: 92, 1929b: 40, 58, 1937a: 234, 1937b: 129; Vandel 1958: 82; Schmalfuss 1972a: 50.

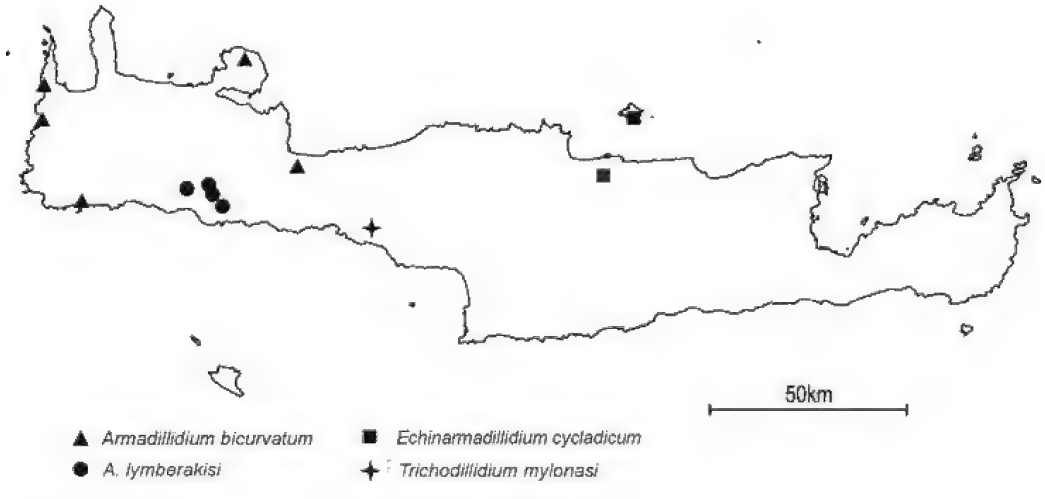
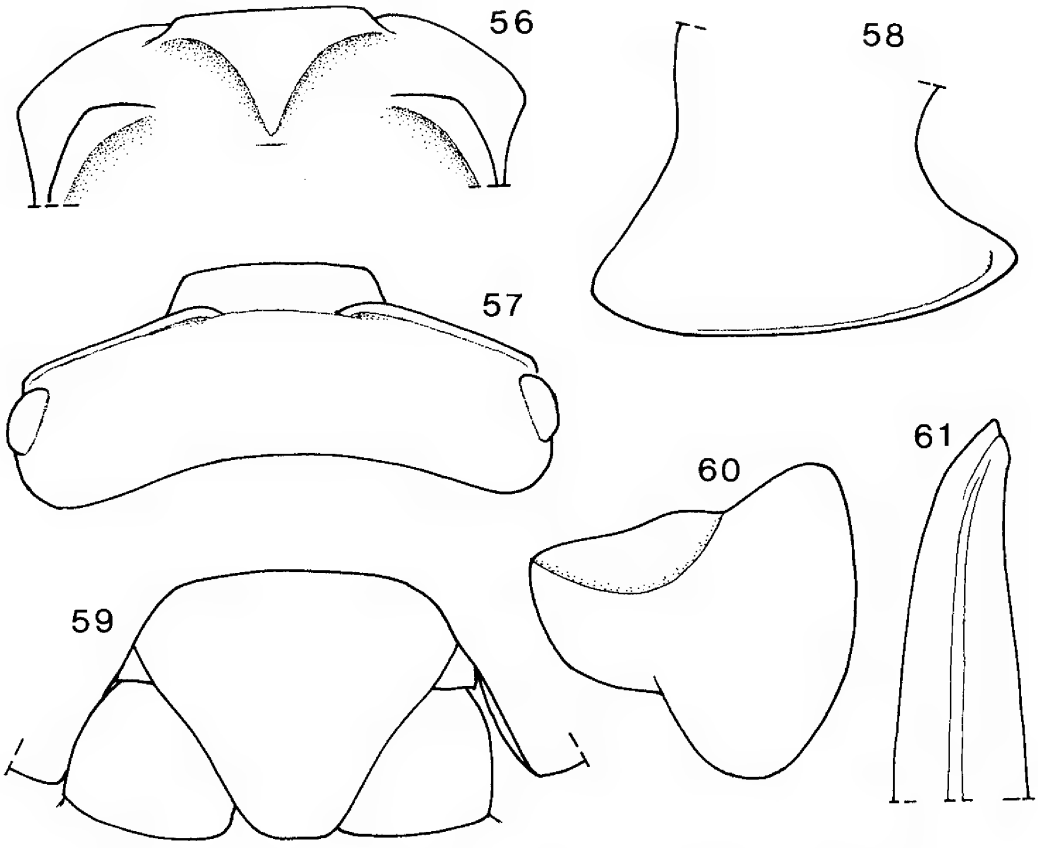


Fig. 55. Cretan records of *Armadillidium bicurvatum*, *Armadillidium lymberakisi* n. sp., *Echinarmadillidium cycladicum* and *Trichodillidium mylonasi* n. sp.



Figs. 56–61. *Armadillidium lymberakisi* n. sp., holotype ♂, 6.5 × 3.8 mm (SMNS T521). – **56**. Head in frontal view. **57**. Head in dorsocaudal view. **58**. Pereion-epimeron I in dorsolateral view. **59**. Telson and uropods in situ, dorsocaudal view. **60**. Pleopod-exopodite I. **61**. Apex of pleopod-endopodite I.

Description, figures, systematics: VANDEL 1962: 796.

Material examined: Many samples from all over Crete and Día Island (SMNS, PCUP, NHMC).

Records: **Crete**: all parts. – **Día Island**.

Distribution: France (Bretagne); Portugal; Mediterranean coasts east to Libya and the Aegean coast of Asia Minor; coasts of southwestern Black Sea (SCHMALFUSS 2000b: map fig. 3).

Armadillidium lymberakisi n. sp.

Holotype: ♂, 6.5 × 3.8 mm, pref. Chaniá, Lefká Óri, Volakiás, 2000 m, leg. MALICKY, 3.V.1984 (SMNS T521).

Paratypes: 3 ♀♀ without marsupium, 2 juveniles, same data as holotype (SMNS T522). – 1 ♂, pref. Chaniá, Lefká Óri, 2200 m, leg. BERON & BESHKOV, 25.IX.1974 (SMNS T523). – 2 ♀♀, one with marsupium, pref. Chaniá, Lefká Óri, E Páchnes, 2000 m, above timber line, leg. HASSALL & SCHMALFUSS, 29.V.2001 (SMNS T524). – 2 ♂♂, 2 ♀♀, pref. Chaniá, Lefká Óri, 2100 m, leg. LYMBERAKIS, 6.VIII.1992 (NHMC 82.1.3).

Additional material: Hundreds of specimens collected by PETROS LYMBERAKIS in pitfall traps on Lefká Óri, at 2000 m (24°03′16″N, 35°17′18″E) (NHMC) (see LYMBERAKIS et al. 2003).

Fig. 62. *Armadillidium lymberakisi* n. sp., holotype ♂ (SMNS T521), SEM, air-dried, distal part of pereiopod I.

Description:

Animals capable of euspheric conglobation, tergites forming a semicircle in cross-section, epimera vertical (*vulgare*-type). Antennae are protected inside the conglobated animal (endo-antennal) as in all species of the genus.

Maximum dimensions: ♀ 8.5 × 3.5 mm, ♂ 6.5 × 3.8 mm.

Colouration: Greyish brown with usual muscle-spots, epimera lighter.

Cuticular structures: Tergites completely smooth as in *A. vulgare*.

Head: Frontal triangle wider than high, with straight upper margin, upright, detached from frons, so an open slot is formed behind the triangle (Figs. 56–57). Eyes with around 16 ommatidia.

Pereion: Epimeron I posteriorly with rounded angle (Fig. 58).

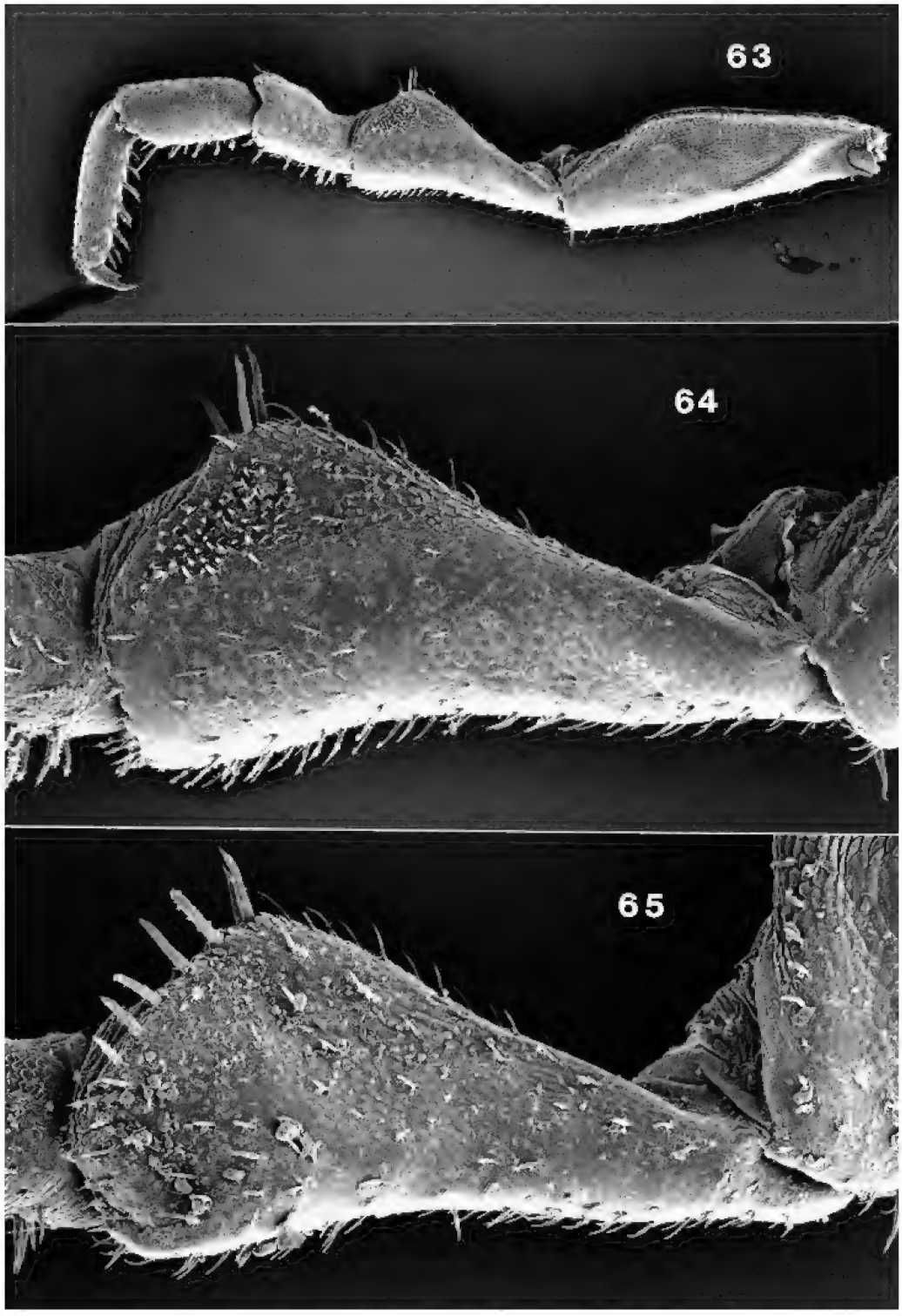
Telson wider than long, with truncate apex (Fig. 59).

♂ pereiopod I (Fig. 62) with usual brush of spines ventrally on carpus. ♂ pereiopod VII (Figs. 63–65) with ischium ventrally slightly concave.

♂ pleopod-exopodite I (Fig. 60) as wide as long, with triangular posterior process; endopodite I (Fig. 61) with apex obliquely pointing outwards, but this apex much shorter and thinner than in *A. vulgare*. Uropod-exopodite see Fig. 59.

Differential diagnosis: The new species is very similar to *A. marmoratum* Strouhal, 1929 and could be closely related to this species, which lives in littoral biotopes. In the new species the frontal shield surpasses the frontal ridges and is visible in dorsocaudal view as a trapezoidal quadrangle, while in *A. marmoratum* it does not surpass the frontal ridges, the apex of the telson is truncate and not completely rounded, the ♂ pereiopod VII has the ischium ventrally concave, while in *A. marmoratum* it is completely straight, and the ♂ pleopod-exopodite I has a shorter and more rounded hind-lobe than *A. marmoratum*.

Map with records: Fig. 55.



Figs. 63–65. *Armadillidium lymberakisi* n. sp., holotype ♂ (SMNS T521), SEM, air-dried. – **63**. Pereiopod VII, frontal side. **64**. Ischium of pereiopod VII, frontal side. **65**. Ischium of pereiopod VII, caudal side.

Armadillidium marmoratum Strouhal, 1929

References: Strouhal 1929b: 39, 64; Schmalfuss 1972a: 50.
Description, figures: Strouhal 1929b.
Material examined: Samples from all parts of Crete (SMNS).

Records: **Crete**: all parts.
Distribution: Coasts of eastern Mediterranean (Aegean to Egypt) and southwestern Black Sea (Schmalfuss 2000b: map fig. 4).

Armadillidium vulgare Latreille, 1804

References: Cecconi 1895: 189; Strouhal 1929b: 40, 1937a: 245; Vandel 1958: 82; Schmalfuss 1972a: 51; Andreev 1986: 162.
Description, figures, systematics: Vandel 1962: 826.
Material examined: Samples from all parts of Crete (SMNS).

Records: **Crete**: all parts.
Distribution: Originally Europe, secondarily introduced to anthropogenous biotopes all over the world (Vandel 1962; Greek records: Schmalfuss 2000b: map fig. 2).

Echinarmadillidium cycladicum Schmalfuss & Sfenthourakis, 1995

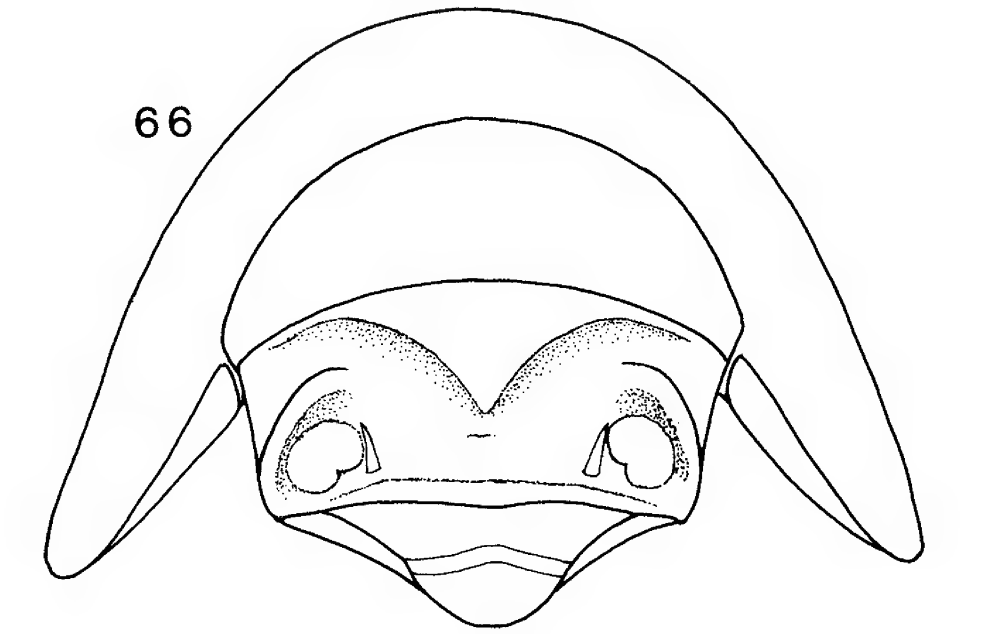
Reference: Schmalfuss & Sfenthourakis 1995: 4.
Description, figures: Schmalfuss & Sfenthourakis 1995.
Material examined: 1 ♂, pref. Irákleio, Knosós, leg. Beron, 11.I.1968 (SMNS 2080).

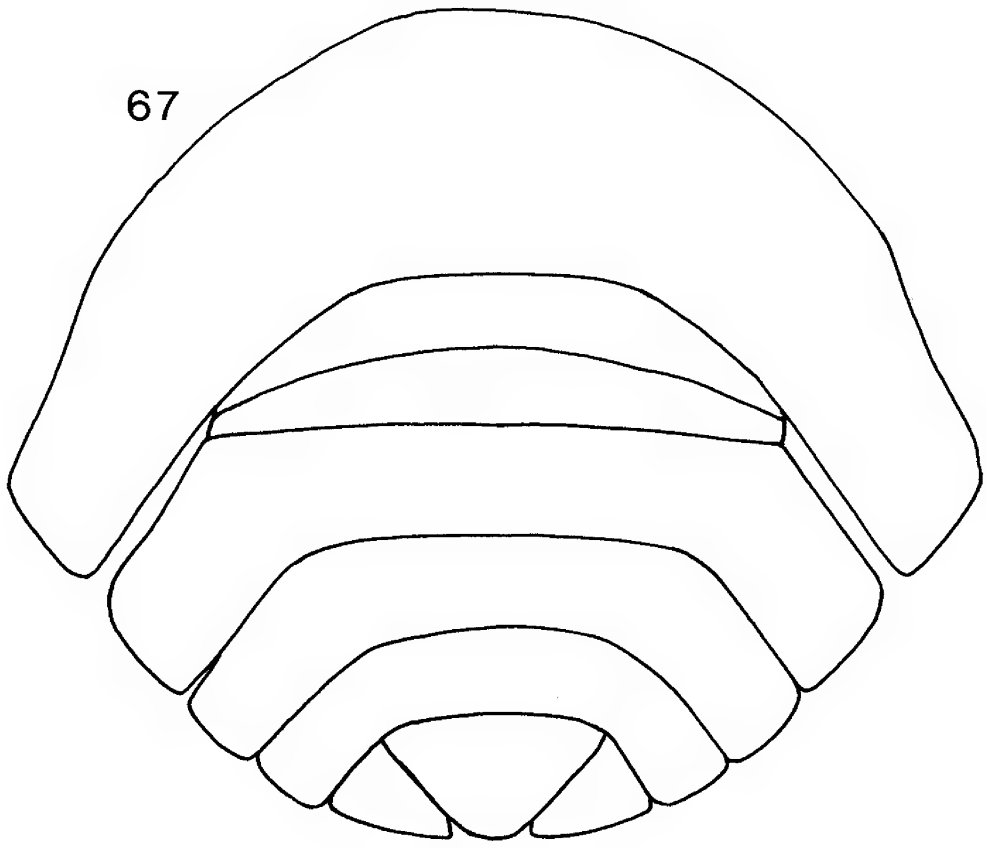
Records (map Fig. 55): **Crete**: Knosós. – **Día Island** (Schmalfuss & Sfenthourakis 1995).
Distribution: Southern Kykládes islands and Crete (Schmalfuss & Sfenthourakis 1995, map fig. 44; material examined).

Platanosphaera ariadnae (Vandel, 1958)

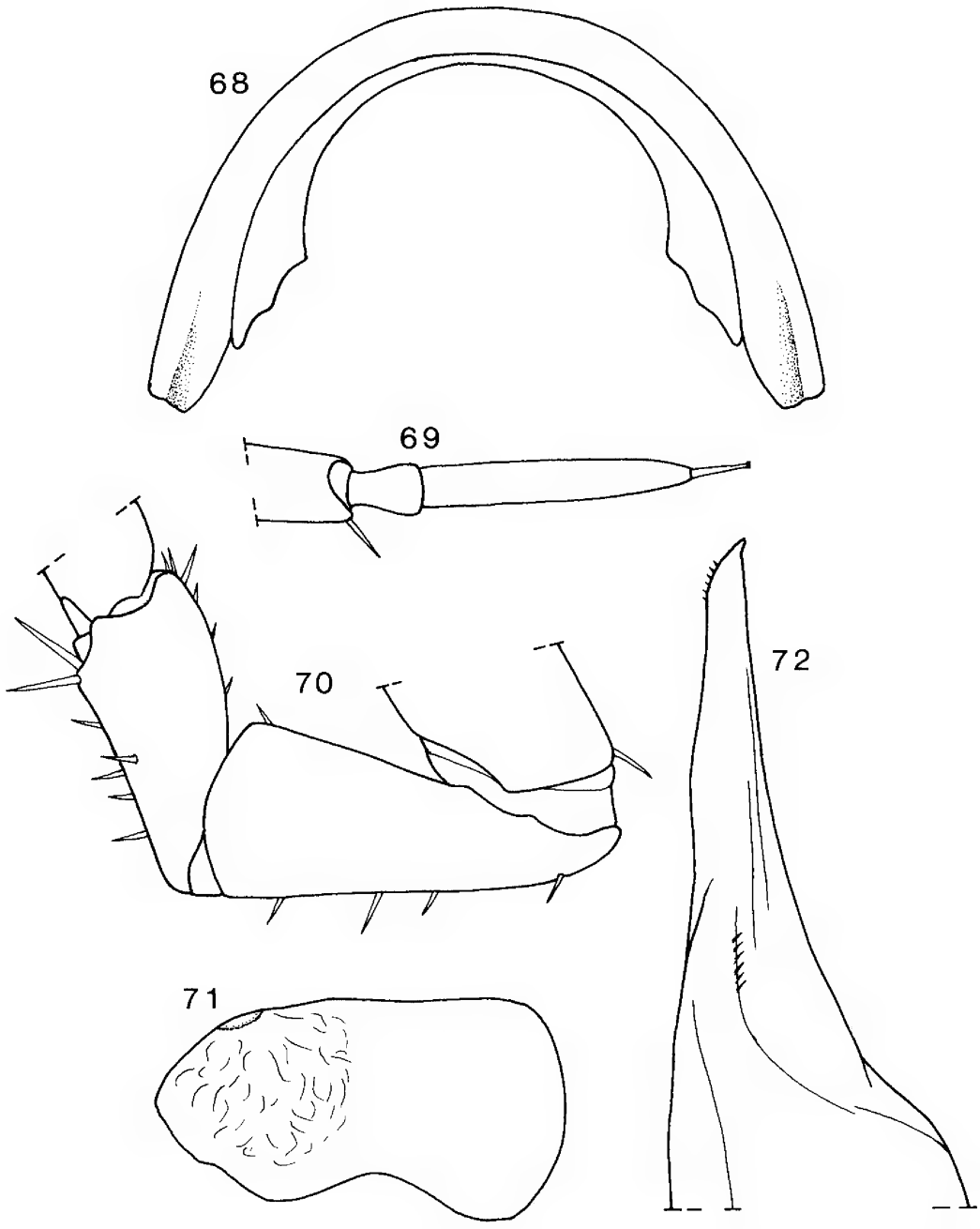
References: Vandel 1958: 93 (*Platanosphoera a.*); Andreev 1986: 162 (*Troglarmadillidium a.*).
Description, figures: Vandel 1958; present paper (Figs. 66–72).
Material examined: 2 ♂♂, 1 ♀, pref. Chaniá, peninsula Akrotíri E of Chaniá, cave Katholikó, leg. Beron & Beshkov, 22.IX.1974 (SMNS 2069). – 6 ♂♂, 7 ♀♀, pref. Chaniá, peninsula Akrotíri E of Chaniá, cave Katholikó, leg. K. Paragamian, 2.III.1987 (KPPC).

Records (map Fig. 73): **Crete**: caves on peninsula Akrotíri E of Chaniá.
Distribution: Only known from caves on peninsula Akrotíri E of Chaniá, western Crete.
Comments: Strouhal (1956) instituted *Platanosphaera* as a subgenus of *Troglarmadillidum* Verhoeff, 1900. Vandel (1958), when he described the species *ariadnae*, raised the taxon to the generic level and gave a new definition for it. Contrary to subsequent publications (e. g. Schmalfuss 2003) we agree with Vandel's view that the *Platanosphaera*-species should be treated as a separate genus. One reason is that a comparison of the *Platanosphaera*-species with the type-species of *Troglarmadillidium* (*T. stygium* Verhoeff, 1900 from the Hercegovina) suggests a





Figs. 66–67. *Platanosphaera ariadnae*, ♀, 5.0 × 2.2 mm (SMNS 2069). – **66**. Head and pereion-tergite I in frontal view. **67**. Pereion-tergite VII and pleon, dorsal view.



Figs. 68–72. *Platanosphaera ariadnae*. – **68**. ♀, 5.0 × 2.2 mm (SMNS 2069), pereion-tergite II in frontal view. **69**. ♂, 4.0 × 1.7 mm (SMNS 2069), antennal flagellum. **70**. As before, pereiopod VII. **71**. As before, pleopod-exopodite I. **72**. As before, pleopod-endopodite I.

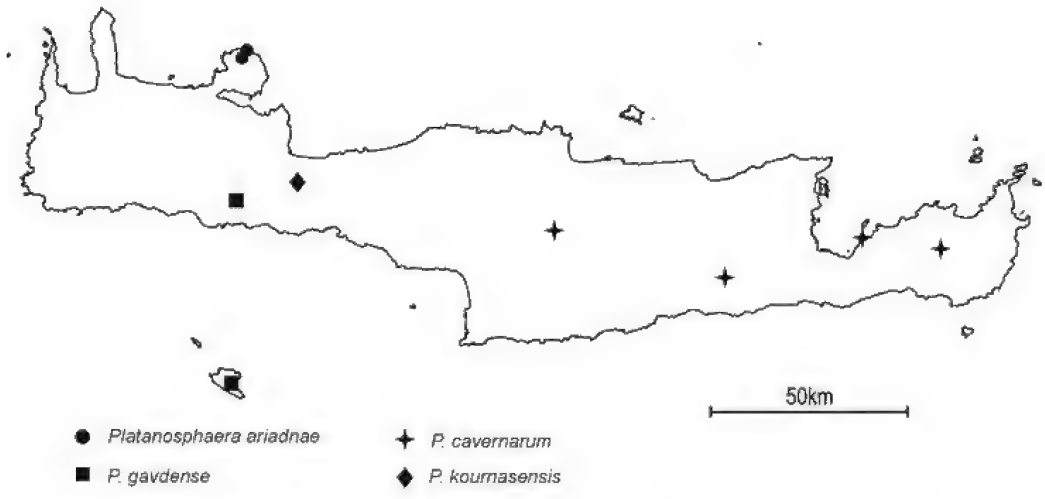


Fig. 73. Cretan records of *Platanosphaera ariadnae*, *P. cavernarum*, *P. gavdense* and *P. kournasensis* n. sp.

convergent evolution of the two groups (e. g. the telson has completely different proportions).

Platanosphaera cavernarum (Vandel, 1958)

Reference: Vandel 1958: 97 (*Armadillidium c.*).

Description, figures: Vandel 1958; present paper (Figs. 74–85).

Systematics: The species is definitely not identical with *Platanosphaera ariadnae*, as it was suggested by Schmalfuss 1979: 30. However, the species certainly is more closely related to the Cretan species of the *Platanosphaera*-group and not to the other Cretan species of *Armadillidium*. Common diagnostic characters are 1) the shortened basal segment of the antennal flagellum, 2) a continuous and complete frontal ridge (supposed to correspond to the linea antennalis of other groups), sometimes with remnants of the interocular ridge, 3) no schisma on pereiopod-epimera I, 4) pereiopod VII without ♂ specialisations, 5) ♂ pleopod-exopodite I without hindlobe, 6) telson triangular with straight sides.

Material examined: 1 ♀, pref. Irákleio, Áno Asítes, cave Nychteridóspilios, leg. Nathenas, 17.III.1990 (KPPC). – 3 ♂♂, 17 ♀♀, pref. Lasíthi, Ágios Geórgios or Tourtoúloi, cave Megálo Katofýgi, leg. Paragamian, 5.IV.1987 (KPPC). – 6 ♂♂, 3 ♀♀, pref. Lasíthi, Kavoúsi, cave Therióspilios, leg. Paragamian, 4.VI.1992 (KPPC). – 2 ♂♂, pref. Lasíthi, N of Makrýgialos, Péfkoi, cave Apoloústres, 700 m, leg. Schmalfuss, 26.V.2001 (SMNS 2723).

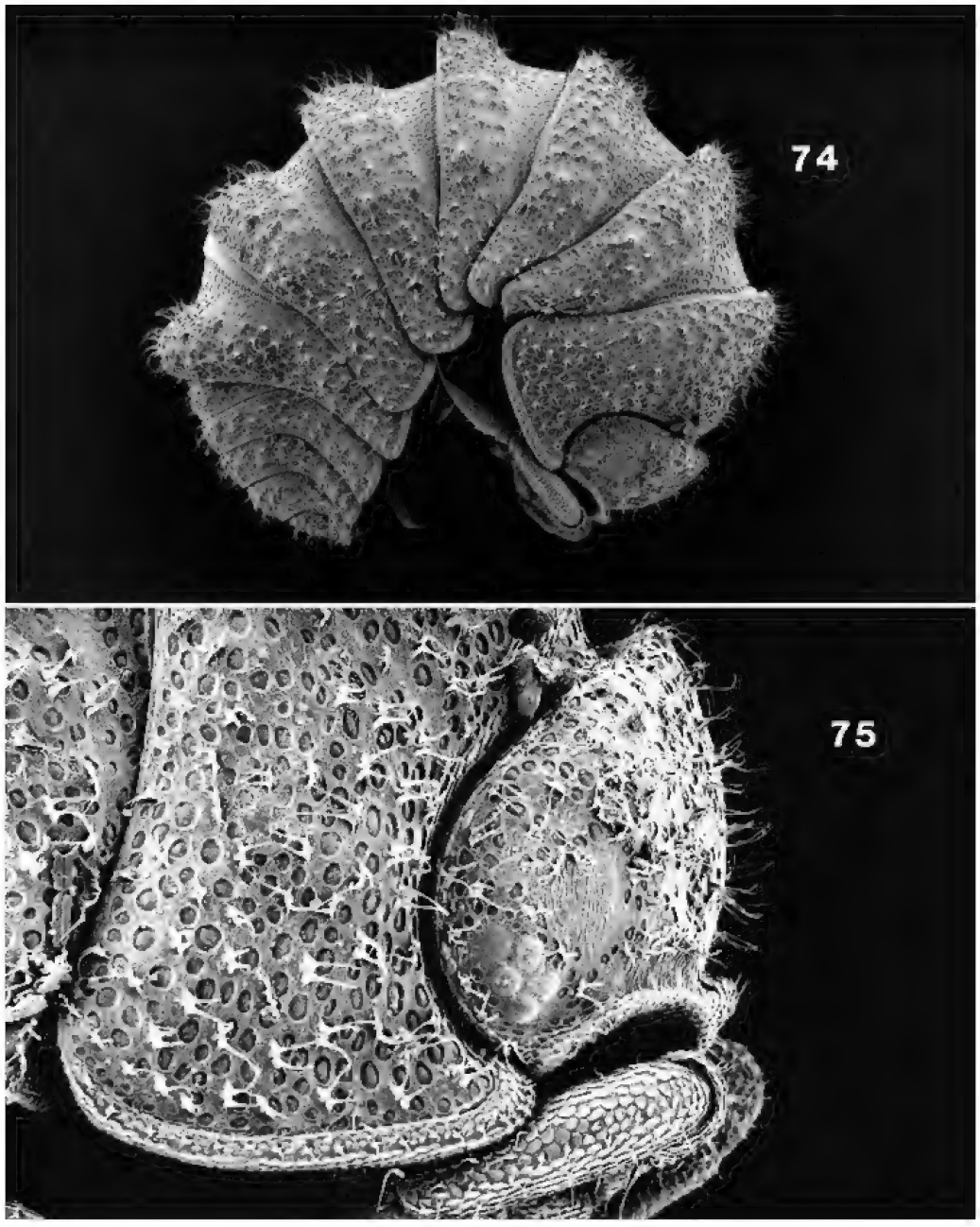
Complementary description:

Cuticular structures: Tergites slightly tuberculated and covered with peculiar hair-like double scale-spines and round depressions (Figs. 74–80).

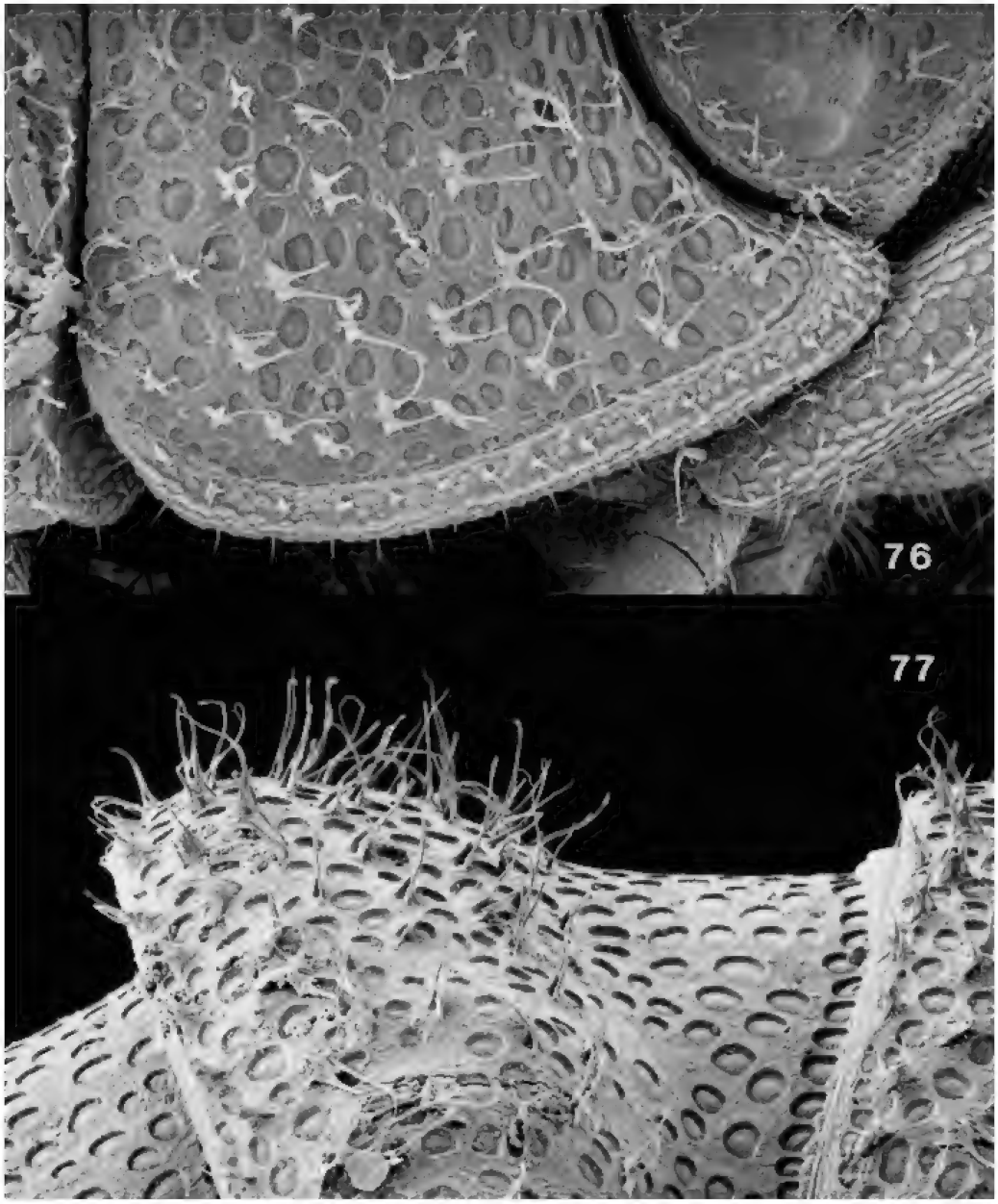
Head with a very pronounced and complete frontal ridge (linea antennalis) and rounded vestiges of the interocular line (Fig. 78). Eyes with 5 ommatidia (Fig. 75).

Pereion-epimeron I with a pronounced ridge laterally, which is covered with scales and bears one row of simple scale-spines (Fig. 76).

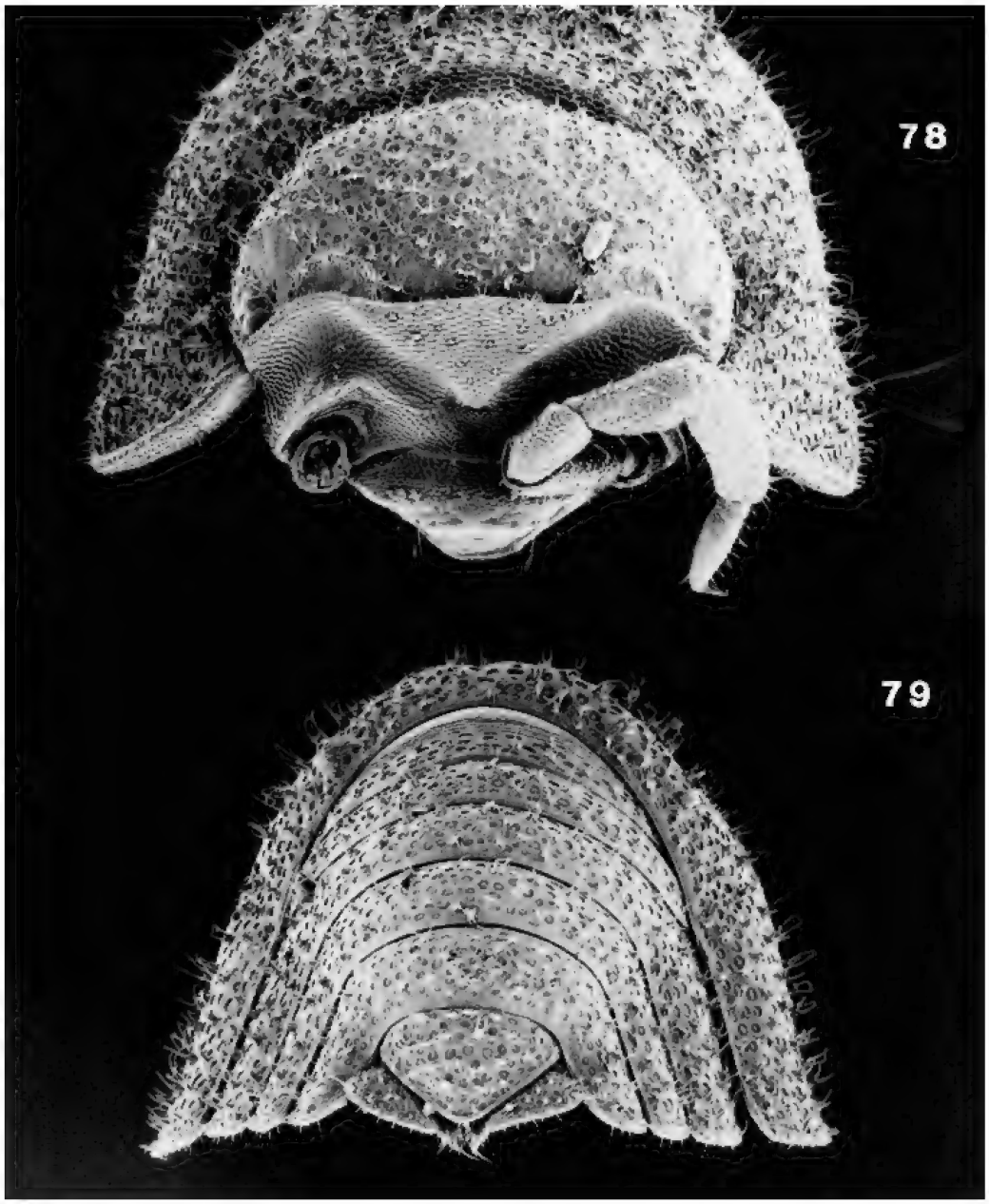
Telson wider than long, with narrowly rounded apex and straight sides (Fig. 80).



Figs. 74–75. *Platanosphaera cavernarum*, ♂ (SMNS 2723), SEM, air-dried. – **74**. Lateral view of whole animal. **75**. Head and pereion-epimeron I, lateral view.



Figs. 76–77. *Platanosphaera cavernarum*, ♂ (SMNS 2723), SEM, air-dried. – **76.** Pereion-epimeron I, lateral view. **77.** Detail of pereion-tergite II.



Figs. 78–79. *Platanosphaera cavernarum*, ♂ (SMNS 2723), SEM, air-dried. – **78**. Head and pereion-tergite I, dorsofrontal view. **79**. Pereion-tergite VII and pleon, caudal view.

Fig. 80. *Platanosphaera cavernarum*, ♂ (SMNS 2723), SEM, air-dried, telson and uropods in situ, caudal view.

Antennal flagellum with distal joint about 5 times longer than proximal one (Fig. 81). Aesthetascs see Fig. 82.

Ischium of ♂ pereiopod VII without apparent modifications (Fig. 83).

Exopodite of ♂ pleopod I without hind lobe (Fig. 84), endopodite I see Fig. 85.

Records (map Fig. 73): **Crete**: caves in the eastern half of the island.

Distribution: Known only from the above-mentioned caves in eastern Crete.

Platanosphaera gavdensis (Schmalfuss, 1972)

Reference: Schmalfuss 1972b: 429 (*Cristarmadillidium g.*).

Description, figures: Schmalfuss 1972b; present paper (Figs. 86–90).

Material examined: 1 ♂, pref. Chaniá, Lefká Óri, southern foothills, 800 m (24°05′04″N, 35°14′31″E), leg. Lymberakis, 6.XI.1991 (SMNS 1429). – 1 ♀, Gávdos Island, Kastrí, leg. Pieper, 21.III.1971 (SMNS 1642). – 2 ♂♂, 4 ♀♀, paratypes, Gávdos Island, leg. Pieper & Runze, 20.–23.III.1971 (SMNS T16).

Complementary description:

Cuticular structures: Tergal parts with very low scale-spines between round depressions (Fig. 87).

Head with pronounced and complete frontal ridge, no interocular lines visible (Fig. 86). Eyes with 5 ommatidia.

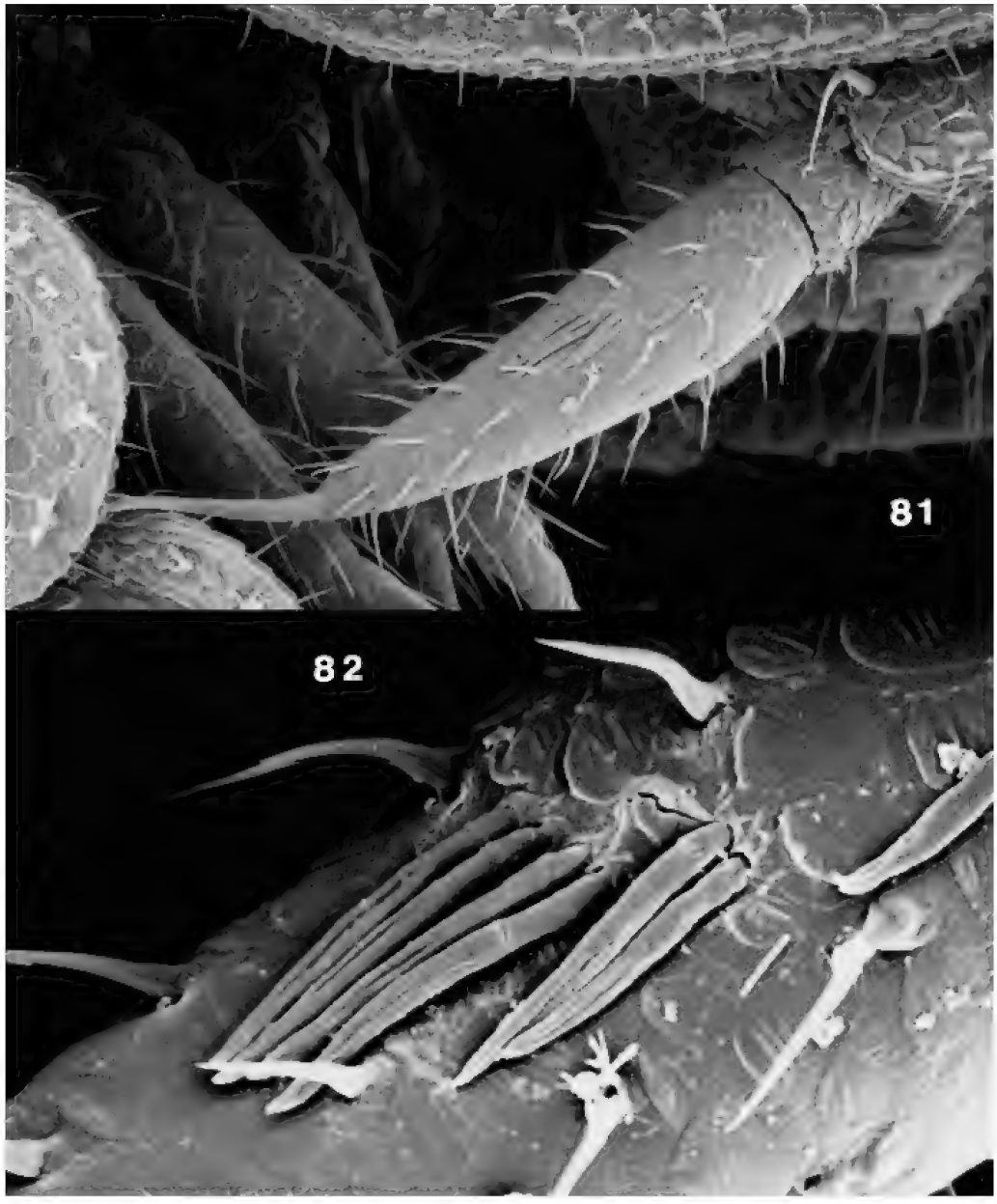
Pereion-tergites smooth and completely semicircular in cross-section (Fig. 86).

Pereiopods I and VII of ♂ see Figs. 88–89, ischium VII without sexual modifications.

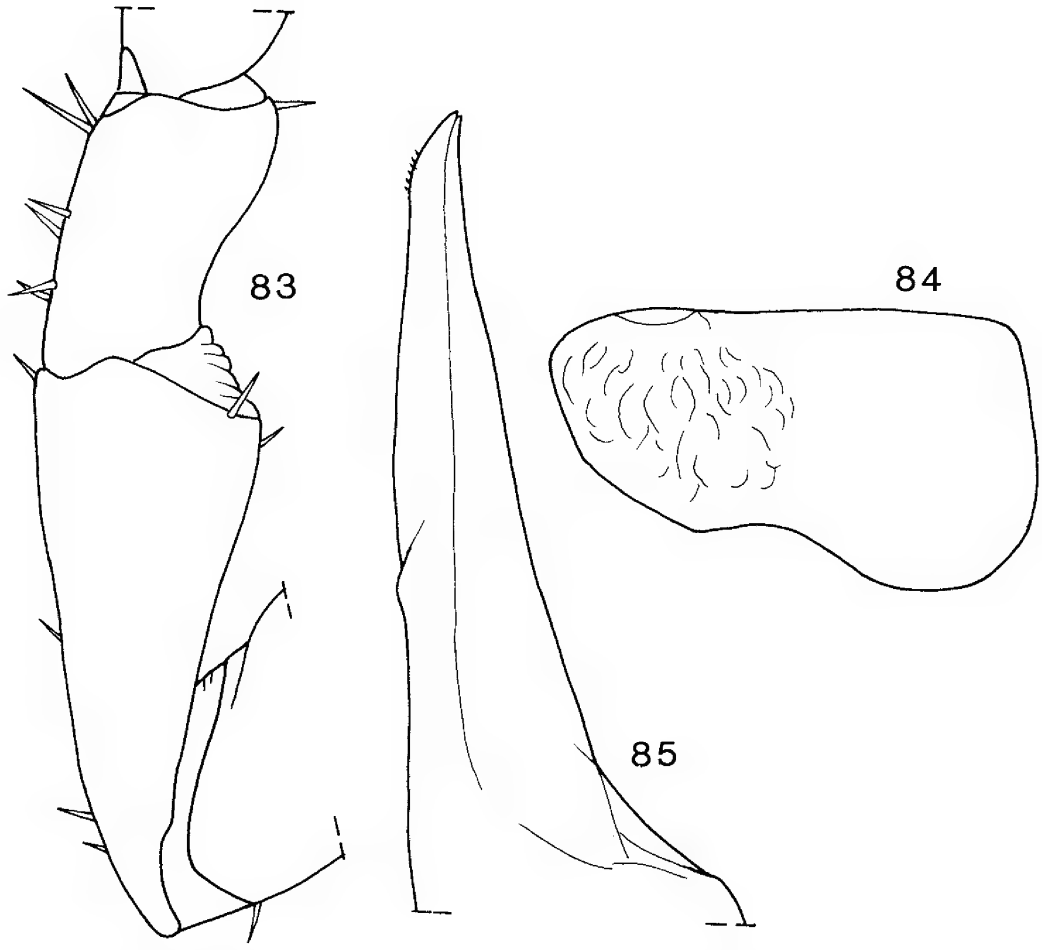
Pleopod I of ♂ see Fig. 90, exopodite without hind-lobe.

Records (map Fig. 73): **Crete**: southwest part of the island (Lefká Óri). – **Gávdos Island** (Schmalfuss 1972b).

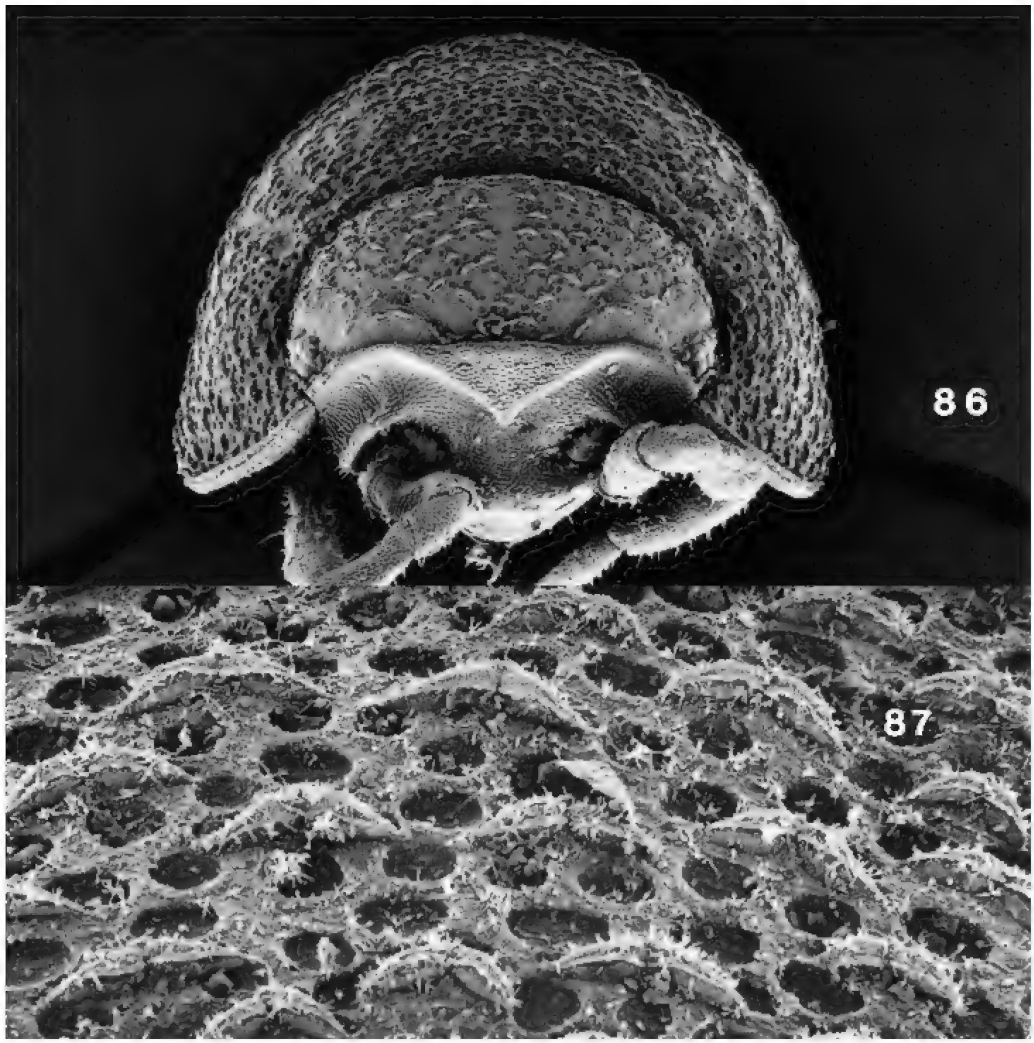
Distribution: Known from western Crete and Gávdos Island.



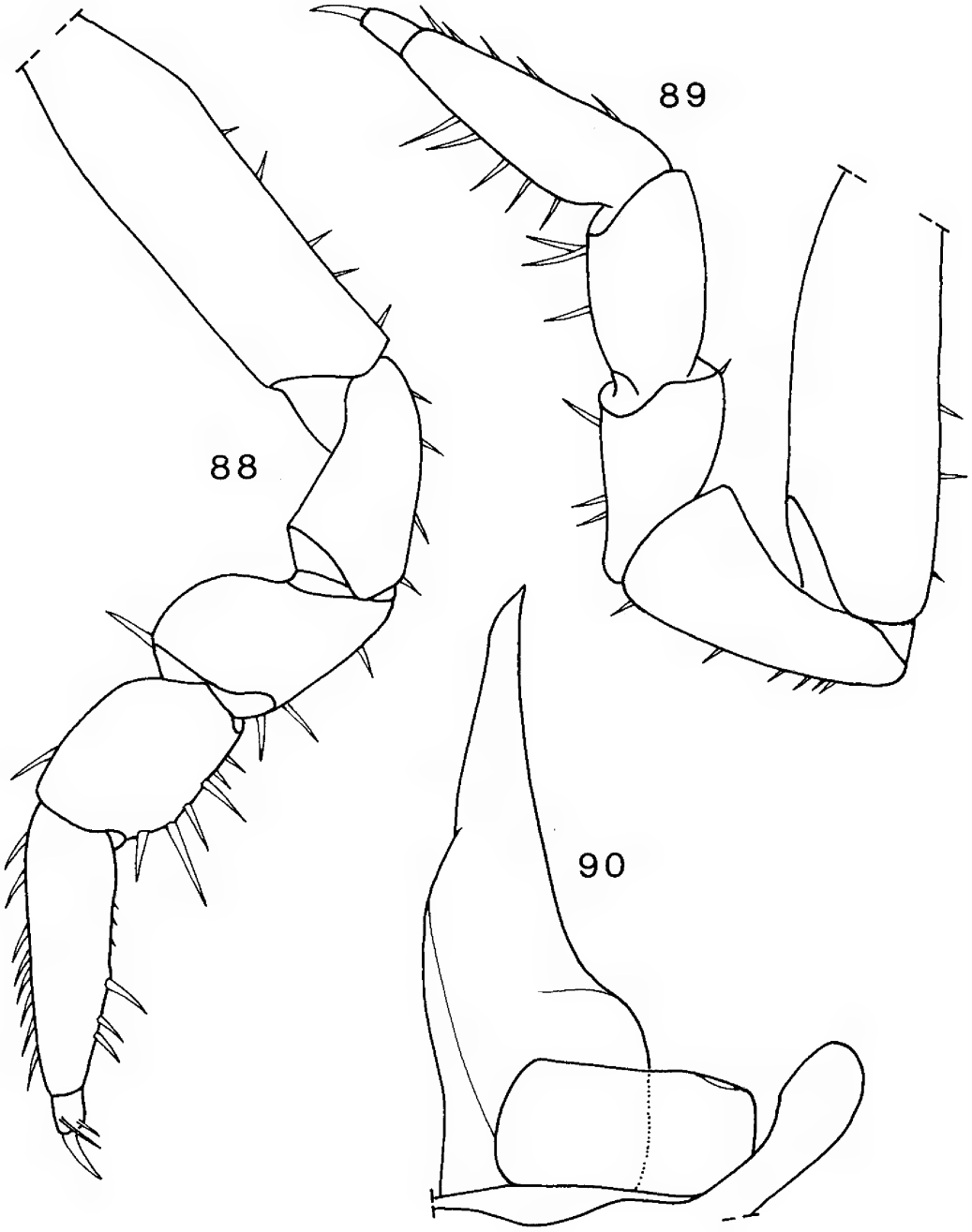
Figs. 81–82. *Platanosphaera cavernarum*, ♂ (SMNS 2723), SEM, air-dried. – **81**. Flagellum of antenna. **82**. Detail of antennal flagellum with aesthetascs.



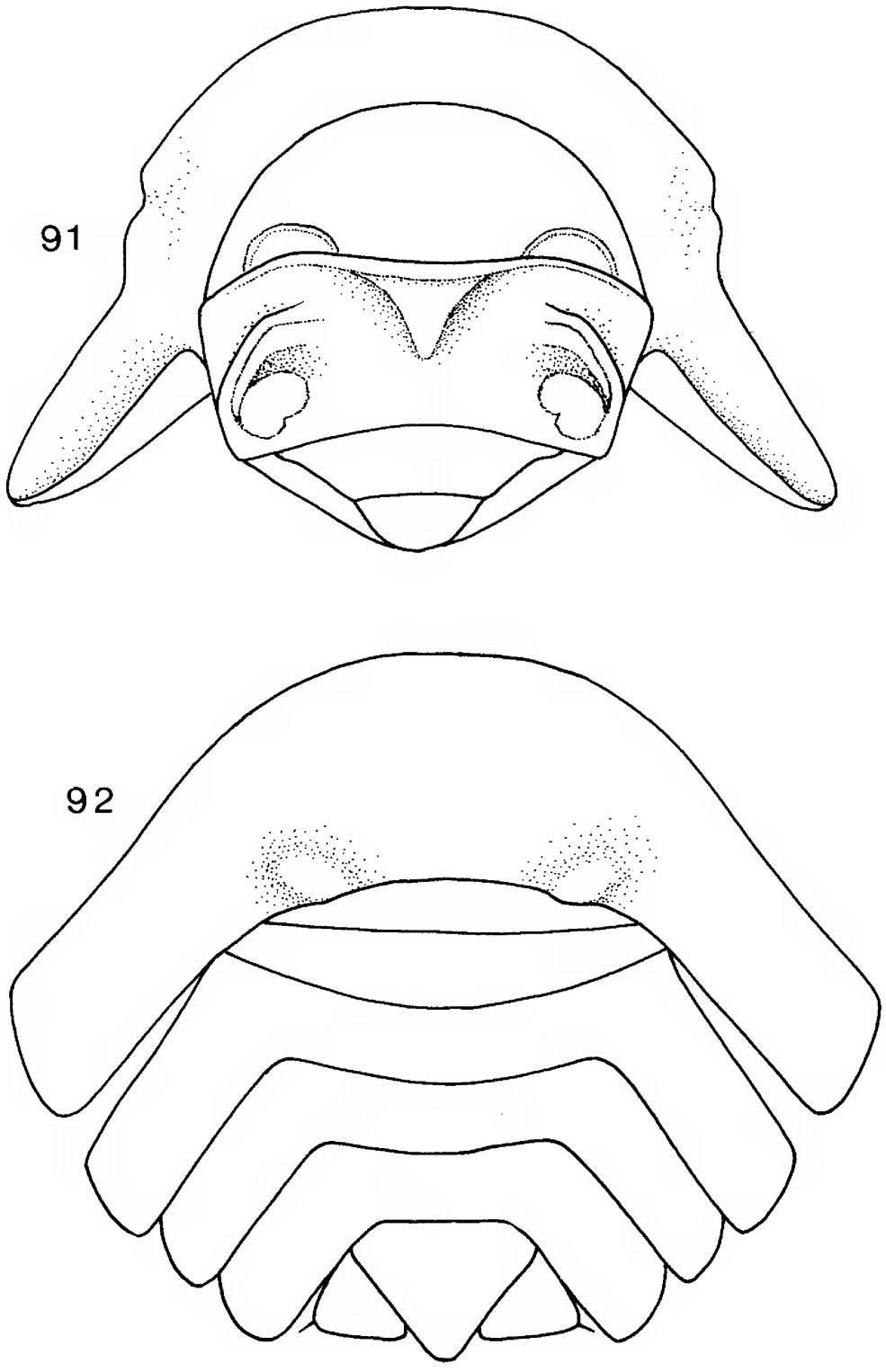
Figs. 83–85. *Platanosphaera cavernarum*, ♂ (SMNS 2723). – **83.** Pereiopod VII. **84.** Pleopod-exopodite I. **85.** Pleopod-endopodite I.



Figs. 86–87. *Platanosphaera gavdensis*, paratype ♀ with marsupium, 3.8 mm long, Gávdos Island (SMNS T16), SEM, critical point treatment. – **86**. Head and pereion-tergite I, dorsofrontal view. **87**. Detail of pereion-tergite I.



Figs. 88–90. *Platanosphaera gavdensis*, paratype ♂, 2.5 mm long, Gávdos Island (SMNS T16). – **88**. Pereiopod I. **89**. Pereiopod VII (not VI !). **90**. Pleopod I.



Figs. 91–92. *Platanosphaera kournasensis* n. sp., holotype ♂, 5 mm long (SMNS T528). – **91.** Head and pereion-tergite I in dorsofrontal view. **92.** Pereion-tergite VII and pleon in dorsocaudal view.

Platanosphaera kournasensis n. sp.

Holotype: ♂, 5.0 mm long, pref. Chaniá, Kournás, cave of Kournás, leg. PARAGAMIAN, 3.III.1987 (SMNS T528).

Paratypes: 3 ♀♀ without marsupium, same collecting data (NHMC 82.1.4 and SMNS T529).

Description:

Maximum dimensions: 5.0 × 2.5 mm.

Colouration: White, without pigmentation.

Cuticular structures: Tergites smooth, but pereion-tergites with lateral ridges.

Head with continuous frontal ridge, behind this two rounded vestiges of interocular ridge (Fig. 91). Eyes completely lacking.

Pereion-tergites with lateral protuberances above epimera (Figs. 91–93), so cross-section not semi-circular as in the other species of the genus. Epimera I and II with medial notches (Fig. 94) much the same as in *Armadillidium vulgare.*

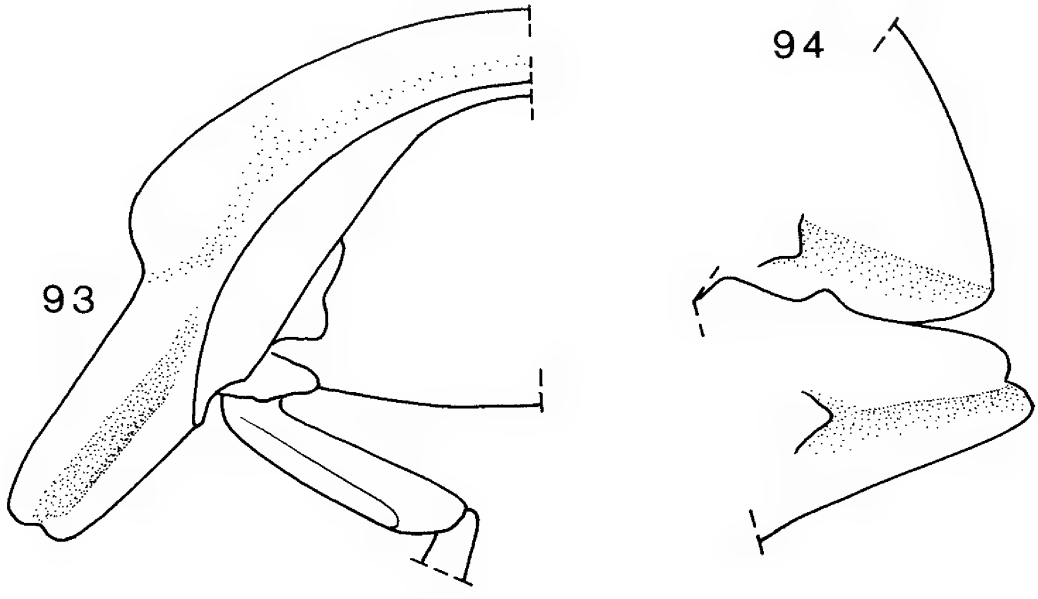
Pleon without tubercles (Fig. 92).

Telson triangular with straight sides (Fig. 92).

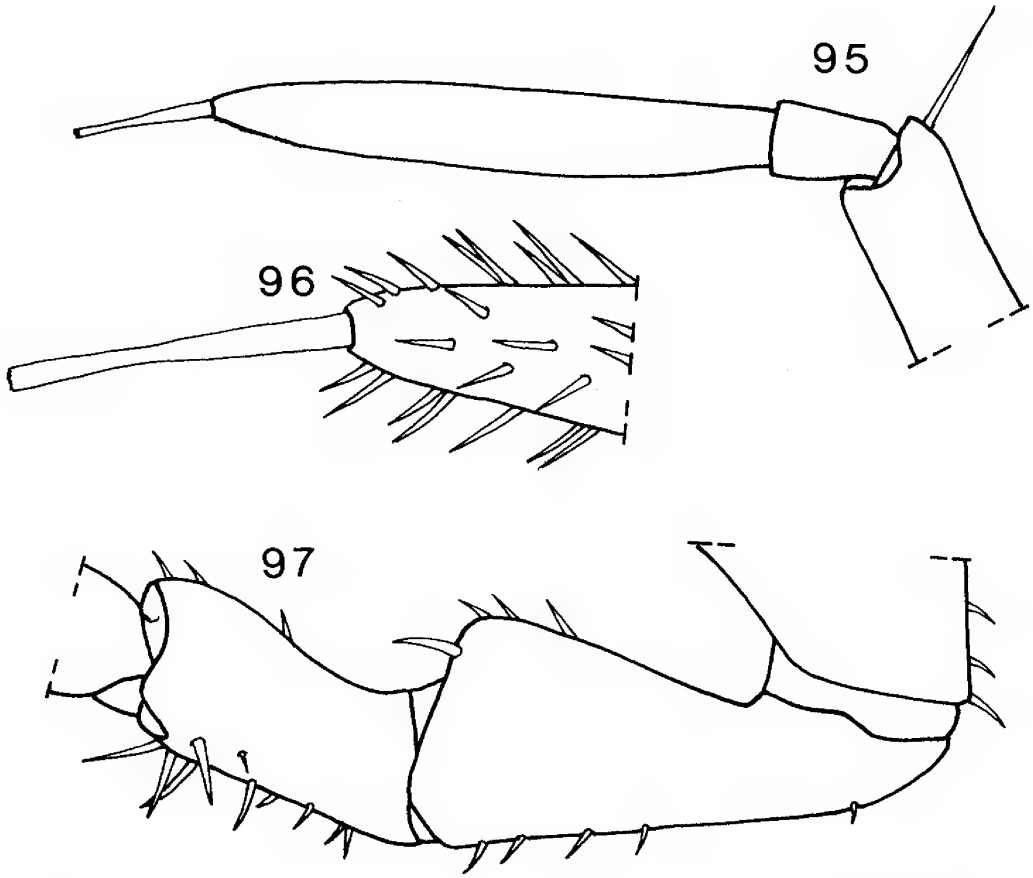
Antennal flagellum with basal joint very short (Fig. 95–96) as in all members of the genus. ♂ pereiopod VII (Fig. 97) with unmodified ischium. ♂ pleopod-exopodite I with rounded inner lobe, hind-lobe missing (Fig. 98), endopodite I see Fig. 99, ♂ pleopod II see Fig. 100.

Differential diagnosis: The main difference towards the other Cretan members of the genus are the lateral bulbous protuberances of the pereion-tergites, followed by slightly concave epimera, while the other species have semi-circular cross-sections.

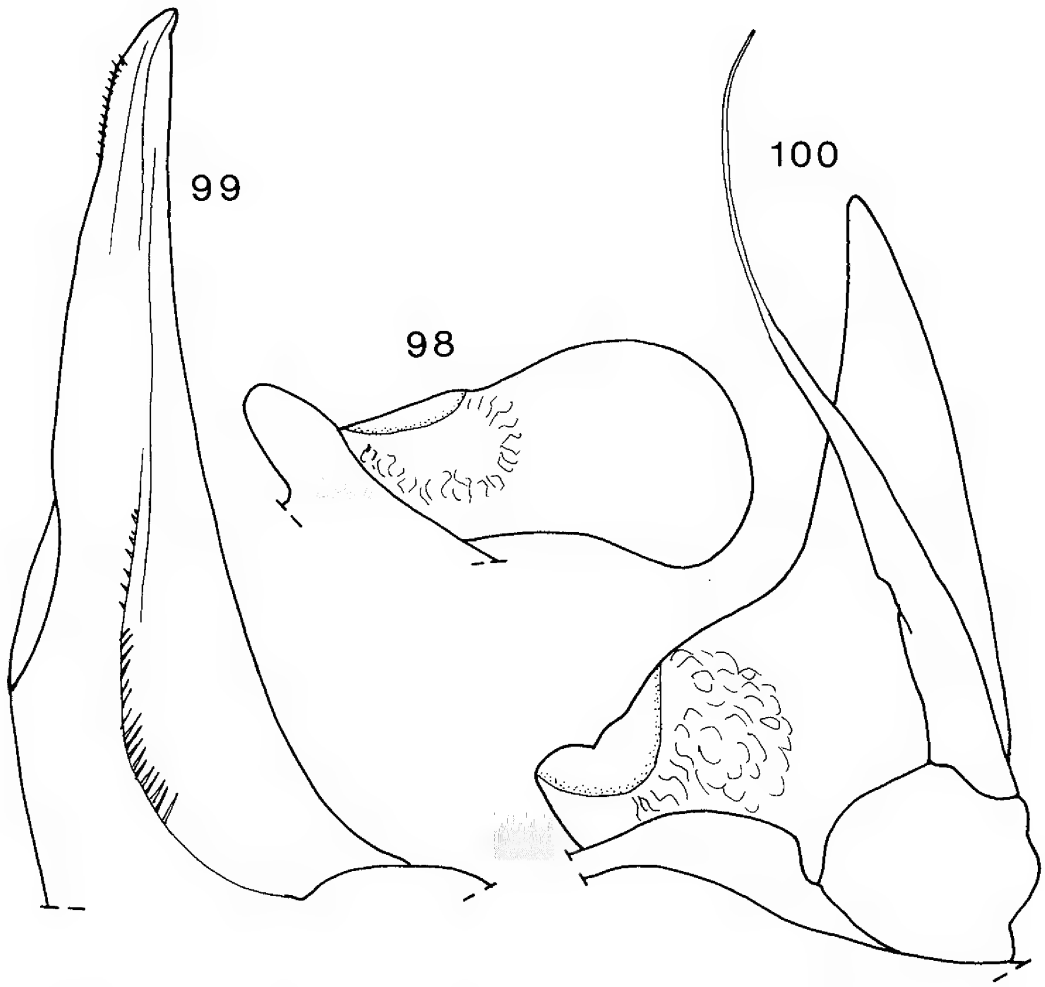
Map with records: Fig. 73.



Figs. 93–94. *Platanosphaera kournasensis* n. sp., holotype ♂, 5 mm long (SMNS T528). – **93.** Pereionite II in frontal view. **94.** Ventral view of pereion-epimera I and II.



Figs. 95–97. *Platanosphaera kournasensis* n. sp., holotype ♂, 5 mm long (SMNS T528). – **95.** Antennal flagellum. **96.** Close-up of antennal apex. **97.** Pereiopod VII.



Figs. 98–100. *Platanosphaera kournasensis* n. sp., holotype ♂, 5 mm long (SMNS T528). – **98**. Pleopod-exopodite I. **99**. Pleopod-endopodite I. **100**. Pleopod II.

Schizidium delmastroi n. sp.

Holotype: ♂, 3.9 mm long, pref. Chaniá, between Kándanos and Flória, leg. DELMASTRO, 13.IX.1998 (SMNS T563).

Description:

Dimensions: Length 3.9 mm.

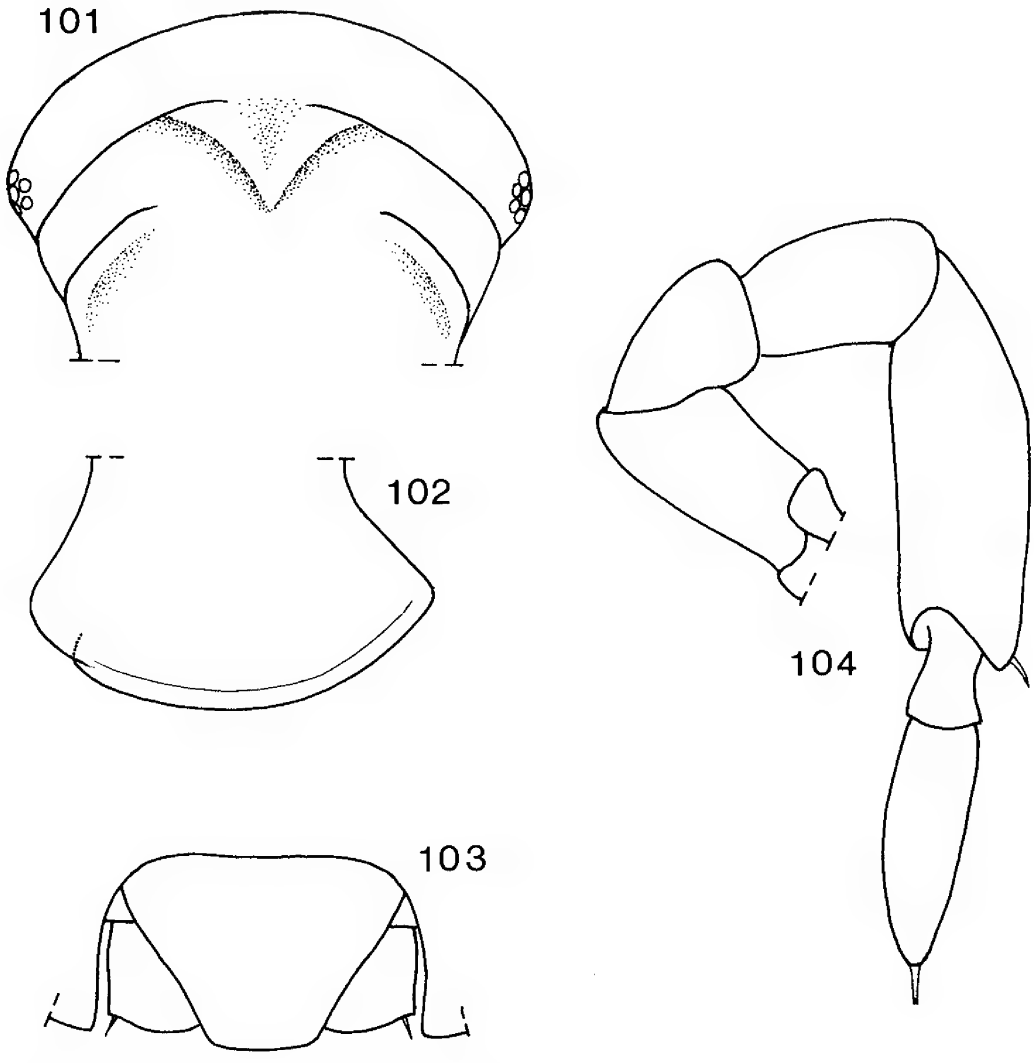
Colouration: White, without pigmentation.

Cuticular structures: Tergites smooth.

Head with frontal ridge interrupted in the middle, no interocular ridge visible (Fig. 101). Rudimentary eyes present, but without pigmentation.

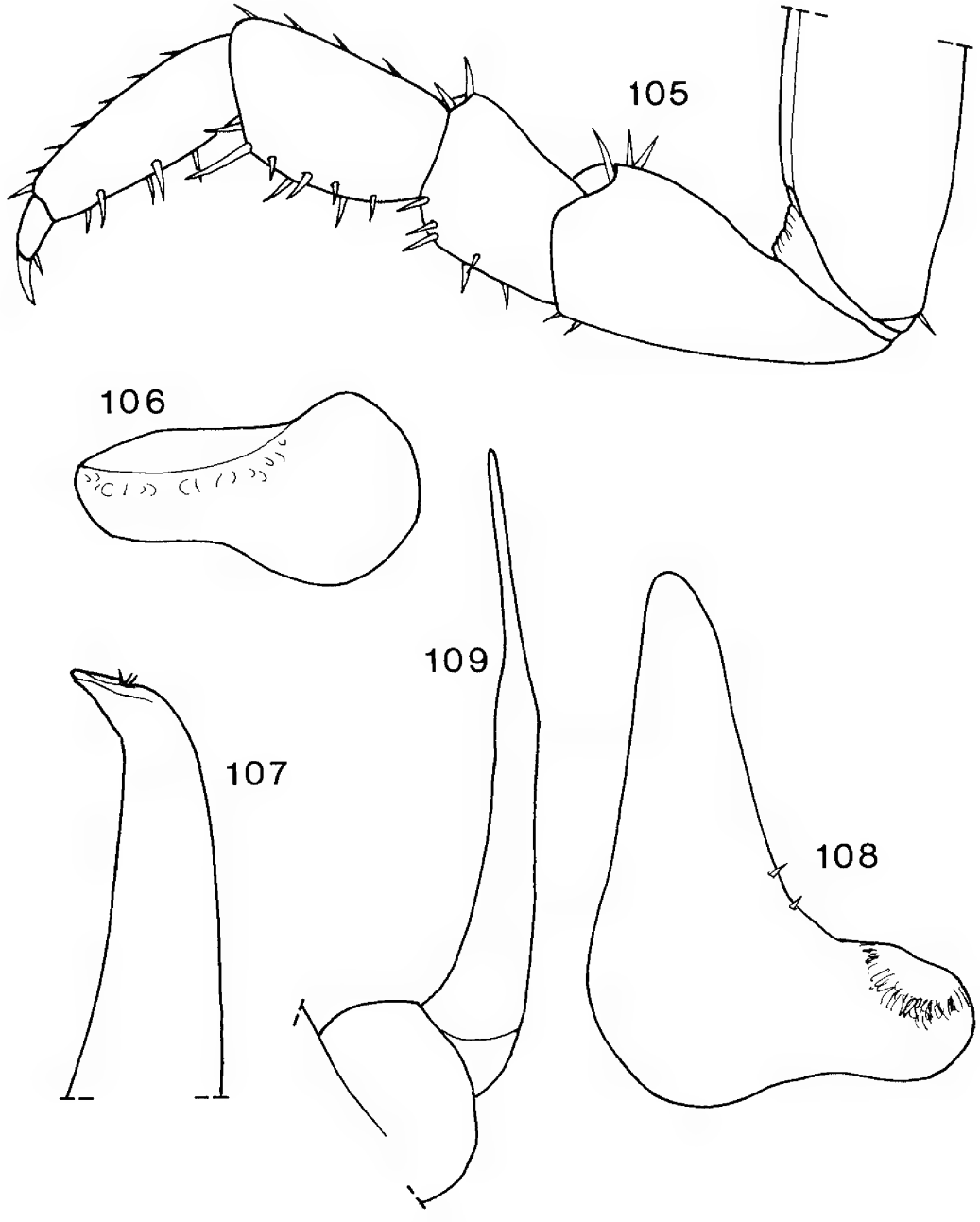
Pereion-epimeron I with schisma, inner lobe much shorter than outer (Fig. 102), margin with pronounced exterior ledge.

Telson trapezoidal, wider than long (Fig. 103).



Figs. 101–104. *Schizidium delmastroi* n. sp., holotype ♂, 3.9 mm long (SMNS T563). – **101.** Head in frontal view. **102.** Pereion-epimeron I, lateral view. **103.** Telson and uropods in situ, dorsocaudal view. **104.** Antenna.

Antenna stout and thickset, antennal flagellum with basal joint about one fourth of distal joint (Fig. 104). ♂ pereiopod VII (Fig. 105) without conspicuous modifications. ♂ pleopod-exopodite I with rounded inner lobe, hind-lobe missing (Fig. 106), endopodite I see Fig. 107, ♂ pleopod II see Figs. 108–109.



Figs. 105–109. *Schizidium delmastroi* n. sp., holotype ♂, 3.9 mm long (SMNS T563). – **105.** Pereiopod VII. **106.** Pleopod-exopodite I. **107.** Pleopod-endopodite I. **108.** Pleopod-exopodite II. **109.** Pleopod-endopodite II.

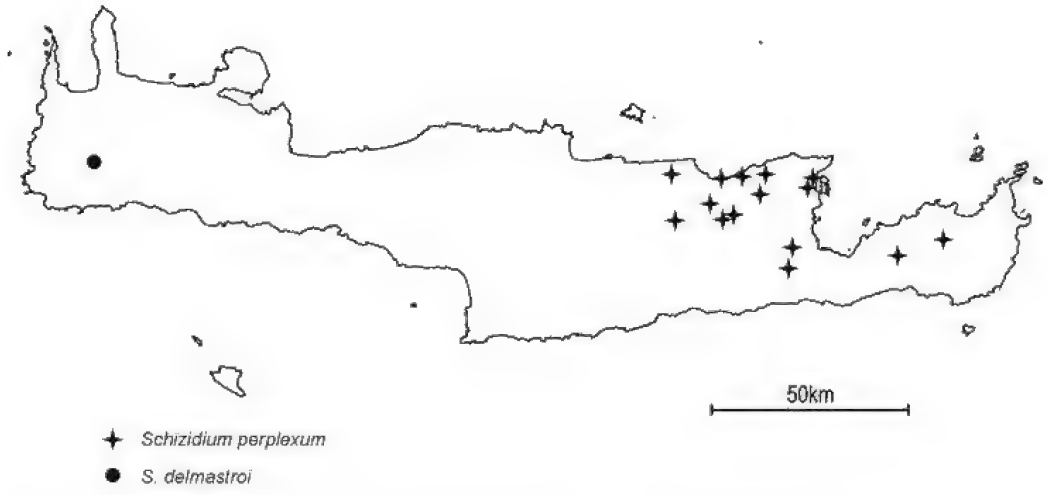


Fig. 110. Cretan records of *Schizidium delmastroi* n. sp. and *S. perplexum*.

Comments: The new species exhibits characters that suggest a cavernicolous life, the only specimen has however been found outside a cave. The size is very small for a member of the genus *Schizidium*, but all diagnostic characters fit with the definition of the genus.

Differential diagnosis: The new species has an interrupted frontal ridge, which separates it from all other Cretan members of the genus except *S. hybridum*. From this species it differs by its small size, the lack of pigmentation, different proportions of the telson and different relations of the joints of the antennal flagellum.

Map with record: Fig. 110.

Schizidium hybridum (Budde-Lund, 1896)

References: STROUHAL 1929a: 112, 1929b: 39, 77; VANDEL 1958: 82; SCHMALFUSS 1972a: 51, 1975: 57, 1988: 5.

Description, figures: SCHMALFUSS 1988.

Material examined: Many specimens from all parts of Crete up to around 1200 m (SMNS, SSPC, NHMC) and from Ágria Gramvoúsa Island (2 ♂♂, 12 ♀♀, leg. SFENTHOURAKIS, 23.IV.1990, SSPC).

Records: **Crete**: all parts. – **Ágria Gramvoúsa Island**. – **Gávdos Island** (SCHMALFUSS 1975).

Distribution: Southeastern Aegean islands and southwestern Asia Minor (SCHMALFUSS 1988: fig. 2).

Schizidium perplexum (Vandel, 1958)

References: VANDEL 1958: 94, 1964: 739 (*Cretodillium p.*); SCHMALFUSS 1972a: 50, 1975: 56 (*Cretodillium p.*), 1979: 29; ANDREEV 1986: 162; PARAGAMIAN et al. 1987: 165.

Description, figures: VANDEL 1958.

Material examined: Many samples from the localities mentioned below (all material, unless otherwise indicated, in KPPC):

Pref. Lasíthi: Ágios Geórgios or Tourtoúloi, cave Mikró Katofýgi, leg. PARAGAMIAN, 5.IX.1987; Chrysopygí, cave Ágios Stavrós, leg. PARAGAMIAN, 1.III.1993; Péfkoi, cave Apoloústres, leg. PARAGAMIAN, 26.V.2001; Kroústas, cave Trýpa sto Selí, leg. PARAGAMIAN, 23.IV.1993; Kalamáfka, cave Toú Sfakianoú i Trýpa, leg. PARAGAMIAN, 8.IV.2000; Lagoú, pothole Xepatoméni Latsída, leg. PARAGAMIAN, 7.VII.1991; Psychrón, cave of Psychrón (Diktaíon Ándron), leg. PARAGAMIAN, 22.V.1987; Tzermiádo, cave of Tzermiádo (Trapéza), leg. PARAGAMIAN, 11.X.1986, leg. PIEPER, 12.IV.1987 and 24.IV.1991 (SMNS 2163 and 2306); Mílatos, cave of Mílatos, leg. PARAGAMIAN, 11.X.1986 and 3.IV.1987, leg. C. & P. DEELEMAN, 20.X.1882 (SMNS 2578), 6.IV.1983 and 9.V.1986 (SMNS 2144); Mílatos, cave Achnístres, leg. PARAGAMIAN, 15.V.1993; Vrachási, cave Peristerás, leg. PARAGAMIAN, 11.X.1986 and 6.IX.1987; Pinés, cave Achnístres, leg. PARAGAMIAN, 4.V.1993; Pinés, cave Latsída sta Lakkiá, leg. PARAGAMIAN, 4.V.1993; NW of Ágios Nikólaos, cellar of deserted monastery Moní Arétiou, leg. PIEPER, 23.IV.and 24.XI.1991 (SMNS 2305 and 2317); 7 km N of Makrýgialos, cave Vréiko, leg. SCHMALFUSS, 27.V.2001 (SMNS 2722); 13 km S of Neápoli, cave Atziganóspilios (Adrianoú), leg. SCHMALFUSS, 16.IV.2003 (SMNS 2755).

Pref. Irákleio: Avdoú, cave Faneroméni, leg. PARAGAMIAN, 6.III.1999; Kastélli, cave Monís Kaléri, leg. PARAGAMIAN, 1.XII.1987; Mália, cave Tis Margiás o Spílios, leg. FAZOS, 30.I.1998; Skoteinó, cave Agía Paraskeví, leg. PARAGAMIAN, 3.IV.1987.

Records (map Fig. 110): **Crete**: caves in eastern part.
Distribution: Known only from caves in eastern Crete.

Schizidium schmalfussi Sfenthourakis, 1992

Reference: SFENTHOURAKIS 1992: 206.
Description, figures: SFENTHOURAKIS 1992.
Records: **Día Island** (SFENTHOURAKIS 1992).
Distribution: Known only from Día Island.

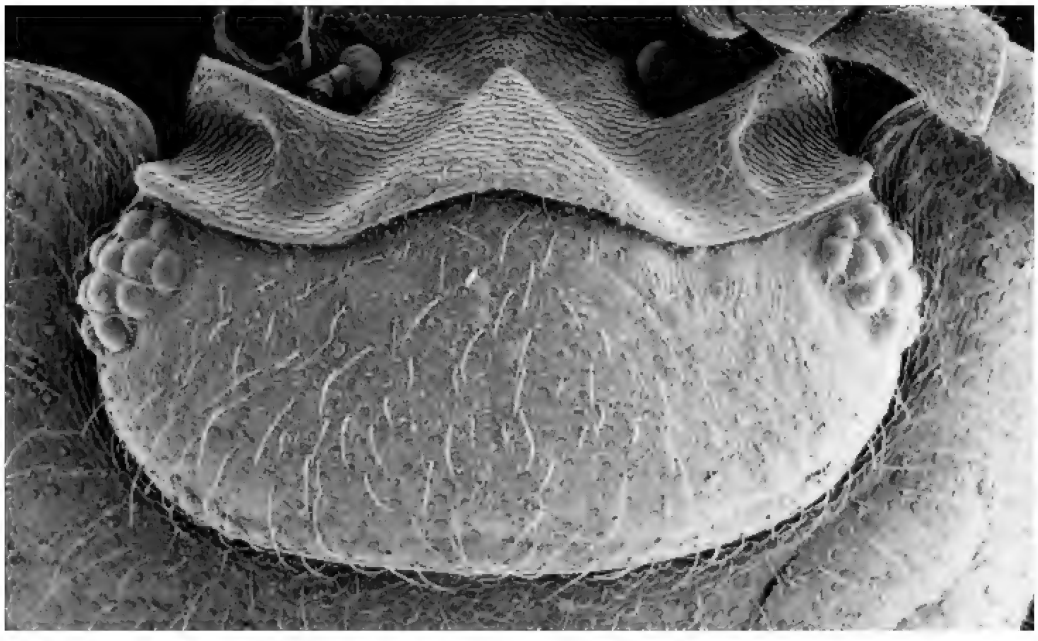


Fig. 111. *Trichodillidium mylonasi* n. sp., holotype ♂, 4.0 × 1.7 mm (SMNS T525), head in dorsal view.

Trichodillidium mylonasi n. sp.

Holotype: ♂, 4.0 × 1.7 mm, pref. Réthymno, Kourtaliótiko Gorge between Spíli and Plakiás, leg. MYLONAS & VARDINOYIANNIS, V.2001 (SMNS T525).

Paratype: 1 ♂, 5.5 × 2.5 mm, same collecting data (NHMC 82.1.6).

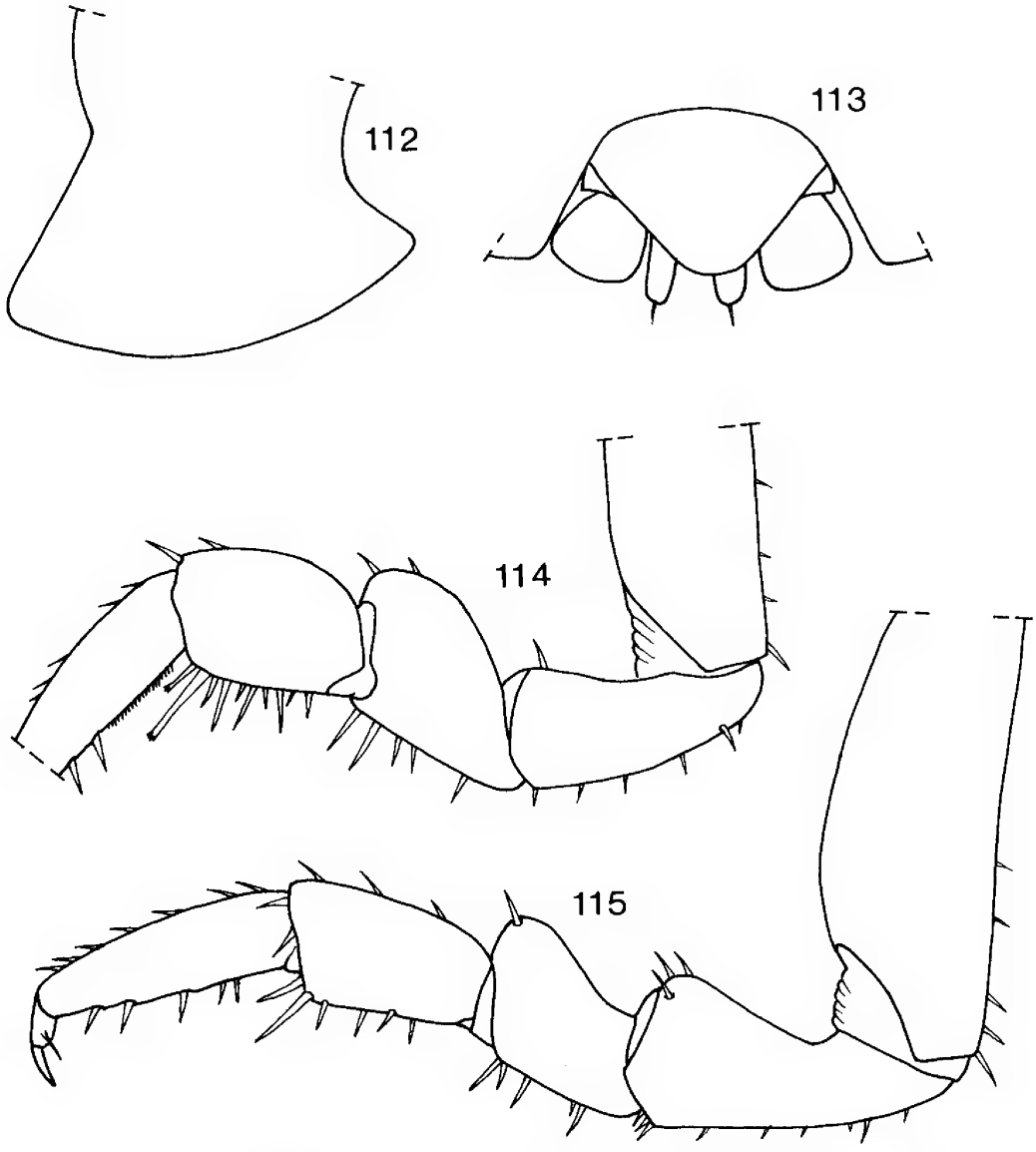
Description:

Euspheric endoantennal conglobation as in the other species of the genus.

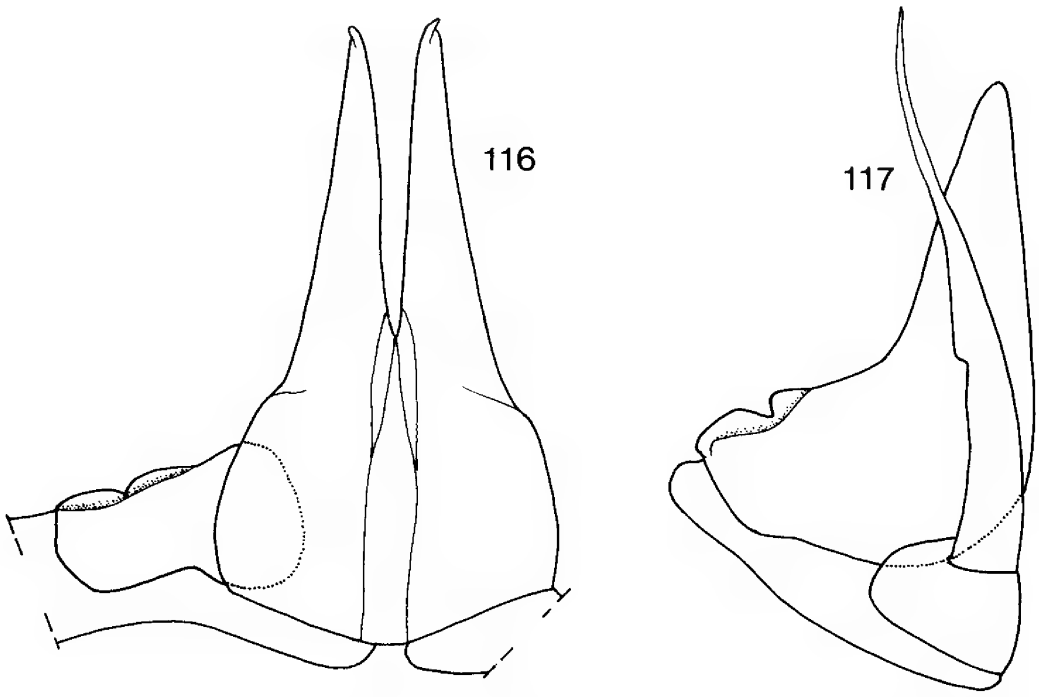
Maximum dimensions: 5.5 × 2.5 mm.

Colouration: Brownish, epimera and telson without pigmentation.

Cuticular structures: Tergal parts densely covered with upright hair-like setae (generic character).



Figs. 112–115. *Trichodillidium mylonasi* n. sp., holotype ♂, 4.0 × 1.7 mm (SMNS T525). – **112.** Pereion-epimeron I. **113.** Telson and uropods in situ, dorsocaudal view. **114.** Pereiopod I. **115.** Pereiopod VII.



Figs. 116–117. *Trichodillidium mylonasi* n. sp., holotype ♂, 4.0 × 1.7 mm (SMNS T525). – **116.** Pleopod I. **117.** Pleopod II.

With the diagnostic characters of the genus (compare SCHMALFUSS 1989): Head of *Eluma*-type, without linea postscutellaris (Fig. 111), pereion-epimera I without schisma, posteriorly with angled indentation (Fig. 112), telson with rounded apex (Fig. 113). Pereiopod I in ♂ without brush on carpus (Fig. 114), ♂ ischium VII without any sexual specialisations (Fig. 115). ♂ pleopod I see Fig. 116, exopodite I with rounded inner lobe, not posteriorly elongated, pleopod II see Fig. 117, exopodites I and II with pronounced indentation at the margins of the respiratory areas as in the other species of the genus.

Differential diagnosis: The genus contains two more species: *T. pubescens* (Strouhal, 1956) from northwestern Greece including the islands of Kérkyra (= Corfu) and Paxoí, and *T. malickyi* Schmalfuss, 1989 from the Aegean island Ándros. The new species from Crete is very similar to the latter species, shows however differences in the structure of the head (antennular lobes in dorsal view rounded, not angular), of the ♂ ischium VII and the ♂ pleopod I (without angular hind-lobe, compare figs. in SCHMALFUSS 1989).

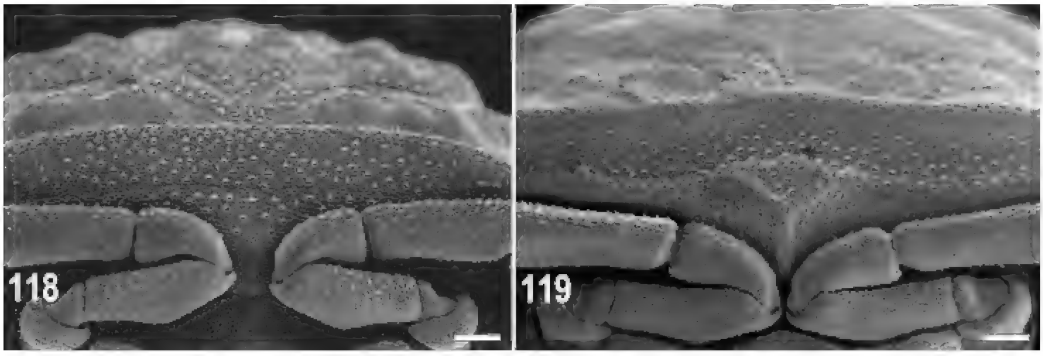
Map with record: Fig. 55.

2.15 Family Armadillidae

Armadillo officinalis Duméril, 1816

References: CECCONI 1895: 189; STROUHAL 1929a: 113, 1929b: 40, 77, 1937a: 249, 1937b: 129; VANDEL 1958: 82; SCHMALFUSS 1972a: 52 (*Pentheus o.*), 1975: 58 (*Pentheus o.*), 1979: 36; ANDREEV 1986: 162.

Description, figures: SCHMALFUSS 1996: 4.



Figs. 118–119. *Armadillo tuberculatus*, SEM, air-dried, frontal view of head. – **118.** Specimen of 9 mm length from Falásarna (pref. Chaniá). **119.** Specimen of 9 mm length from Día Island. – Scale: 0.2 mm.

Material examined: Samples from all parts of Crete up to 1000 m (SMNS, SSPC, NHMC).

Records: **Crete**: all parts (but not found so far on surrounding islands).

Distribution: Coastal regions of the Mediterranean and the western Black Sea (Schmalfuss 1996).

Armadillo tuberculatus Vogl, 1876

References: Budde-Lund 1896: 40, 42 (*A. piger*); Strouhal 1929a: 114, 1929b: 39, 77, 1937a: 249, 1937b: 129; Vandel 1958: 82; Schmalfuss 1972a: 53 (*Pentheus t.*), 1975: 58 (*Pentheus t.*), 1979: 37; Andreev 1986: 162.

Description, figures: Schmalfuss 1996.

Systematics: Sfenthourakis 1991.

Material examined: Samples from all parts of Crete up to 1700 m (SMNS, SSPC, NHMC) and from the surrounding islands Día, Gávdos, Avgó, east and west Paximádia (leg. Mylonas, 27.III.1991, SSPC), and Ágria Gramvoúsa (SSPC, NHMC).

Records: **Crete**: all parts. – **Día Island**. – **Gávdos Island** (Schmalfuss 1975, 1996). – **Avgó Island** (Schmalfuss 1975, 1979). – **Paximádia Islands (east and west)**. – **Ágria Gramvoúsa Island**.

Distribution: Greece: southern Aegean islands and the island of Kastellórizo; Turkey: southwestern Asia Minor (Schmalfuss 1996: map fig. 81).

Comments: The species exhibits a considerable intraspecific variability considering various external morphological structures (Sfenthourakis 1991). Each island or island group houses a population which differs morphologically from the neighbouring populations, Figs. 118 and 119 show the frontal part of the head of specimens from western Crete and from Día Island. At the present state of knowledge it seems, however, more confusing than clarifying to describe all these varieties as different subspecies.

3 Identification key for the species of the archipelago of Crete

1 Species able to conglobate **2**
– Species not able to conglobate **19**
2 Pereion-epimera II–VII separated from tergites with visible sutures ..... ***Tylos ponticus***
– All epimera fully merged with tergites **3**

3 Head simple, without frontal triangle and antennal lobes; telson hour-glass shaped, apex wider than middle part; uropod-basipodites covering the gap between telson and pleon-epimeron V 4
– Head with frontal triangle and antennal lobes; telson triangular or trapezoidal; uropod-exopodites covering the gap between telson and pleon-epimeron V 5
4 Tergites completely smooth ..... *Armadillo officinalis*
– Tergites with tubercles ..... *Armadillo tuberculatus*
5 Tergites covered with simple long hair-like setae (Fig. 111), telson with apex rounded ..... *Trichodillidium mylonasi* **n. sp.**
– Tergites without long hair-like setae or with hair-like double setae 6
6 Tergites smooth, or granulated 7
– Tergites with tubercles ..... *Echinarmadillidium cycladicum*
7 Posterior corner of pereion-epimeron I with schisma (cleavage) 16
– Without schisma 8
8 Small size (< 5 mm long); ommatidia absent or few (less than 10) 9
– Animals longer than 5 mm; eyes with more than 10 ommatidia 12
9 Eyes present 10
– Eyes absent 11
10 Interocular lines behind frontal ridge (Fig. 78) ..... *Platanosphaera cavernarum*
– Without interocular lines (Fig. 86) ..... *Platanosphaera gavdensis*
11 Interocular lines behind frontal ridge (Fig. 91) ..... *Platanosphaera kournasensis* **n. sp.**
– Without interocular lines (Fig. 66) ..... *Platanosphaera ariadnae*
12 Ridge forming upper margin of the frontal triangle reaching the eyes ..... *Armadillidium bicurvatum*
– Ridge forming upper margin of the frontal triangle not reaching the eyes 13
13 Tergal parts granulated ..... *Armadillidium granulatum*
– Tergal parts smooth 14
14 ♂ pleopod-exopodite I much wider than long (ratio around 4 : 7) ..... *Armadillidium vulgare*
– ♂ pleopod-exopodite I as wide as long (Fig. 60) 15
15 Tip of telson rounded ..... *Armadillidium marmoratum*
– Tip of telson truncate (Fig. 59) ..... *Armadillidium lymberakisi* **n. sp.**
16 Interocular lines behind frontal ridge present ..... *Schizidium perplexum*
– Interocular lines missing 17
17 Telson shorter than wide (Fig. 103) ..... *Schizidium delmastroi* **n. sp.**
– Telson as long as wide 18
18 Frontal ridge interrupted in the middle ..... *Schizidium hybridum*
– Frontal ridge continuous ..... *Schizidium schmalfussi*
19 Antennal flagellum with more than 10 articles ..... *Ligia italica*
– Antennal flagellum with smaller number of articles 20
20 Antennal flagellum two-jointed 21
– Antennal flagellum with more than two articles 41
21 Small size (< 5 mm); no pigmentation; without ommatidia 22
– Larger size; usually pigmented; with ommatidia 25
22 Tergites completely smooth; head without lobes ..... *Rodoniscus anophthalmus*
– Tergites with longitudinal ridges; head with large, triangular median lobe 23
23 Telson as long as wide ..... *Platyarthrus lindbergi*
– Telson much shorter than wide 24
24 Conspicuous longitudinal ridges on tergites ..... *Platyarthrus schoeblii*
– Barely visible ridges on tergites ..... *Platyarthrus beieri*
25 Without pleopodal lungs 26
– Pleopodal lungs present 28
26 Telson shorter than uropod-basipodites; cephalic lobes pointed; cephalon and tergites with tubercules ..... *Armadilloniscus ellipticus*
– Telson triangular, longer than uropod-basipodites 27
27 Head with semi-circular median lobe clearly surpassing side-lobes ..... *Bathytropa granulata*
– Head with angular median lobe not surpassing side lobes ..... *Nagurus aegaeus*
28 Pleopodal lungs in all five pleopods 29

– Pleopodal lungs in first two or three pleopods 30
29 Ratio width of head : width of pereion-tergite I = 3 : 8 ..... *Trachelipus cavaticus* **n. sp.**
– Above ratio 3 : 6 ..... *Trachelipus kytherensis*
30 Pleopodal lungs in pleopods 1–3; cephalon without clearly formed lobes ..... *Orthometopon phaleronense*
– Pleopodal lungs only in pleopods 1–2 31
31 Cephalon without lobes 32
– Cephalon with lobes 34
32 Tergites granulated; fully pigmented ..... *Porcellionides pruinosus*
– Tergites smooth; reduced pigmentation 33
33 In caves only; antennae more than half the body length (Fig. 52); less than 10 ommatidia ..... *Porcellionides cavernarum*
– Usually in or near ant nests; antennae less than half the body length; more than 10 ommatidia ..... *Porcellionides myrmecophilus*
34 Antennae short, not surpassing hind margin of pereion-tergite I 35
– Antennae long, surpassing hind margin of pereion-tergite I 37
35 Median cephalic lobe much larger than lateral ones, with conical shape; body oval shaped, covered with short setae ..... *Leptotrichus naupliensis*
– All three cephalic lobes big and rounded 36
36 Hind-margin of pereion-epimeron III slightly concave ..... *Agabiformius lentus*
– Hind-margin of pereion-epimeron III convex ..... *Agabiformius obtusus*
37 Posterior margin of pereion-epimeron I convex ..... *Proporcellio quadriseriatus*
– Posterior margin of pereion-epimeron I at least slightly concave 38
38 Hind margin of pereion-epimeron I without rounded concavity ..... *Porcellio laevis*
– Posterior margin of pereion-epimeron I with pronounced rounded concavity 39
39 Median cephalic lobe large, quadrangular; light yellowish colouration; intense tuberculation; living in the littoral zone ..... *Porcellio lamellatus*
– Median cephalic lobe small and more or less rounded 40
40 Pleon-exopodite I ♂ with triangular hind-lobe, as long as wide ..... *Porcellio obsoletus*
– Pleon-exopodite I ♂ without triangular hind-lobe, much wider than long ..... *Porcellio flavomarginatus*
41 Antennal flagellum with three distinct articles 42
– Antennal flagellum without clearly separated articles 46
42 Pigment usually in distinct star-shaped blots under stereo-microscope; restricted to littoral zone 43
– Coherent pigmentation; not restricted to littoral zone 45
43 Small size (< 5 mm); short appendages; very narrow body; tergites covered with conical structures ..... *Stenophiloscia vandeli*
– Larger size (> 5 mm); long appendages; tergites smooth, covered with setae 44
44 Pleopod-endopodite I ♂ apically with spine at the exterior corner ..... *Halophiloscia couchii*
– This spine not at the very apex, but subapically positioned ..... *Halophiloscia hirsuta*
45 Telson with pointed apex and concave sides; only near running water ..... *Philoscia univittata*
– Telson with rounded apex, sides not concave ..... *Chaetophiloscia cellaria*
46 Smooth tergites 47
– Tergites with ridges or tubercules 49
47 Pleopod-exopodite I ♂ with rounded apex ..... *Trichoniscus fragilis*
– Pleopod-exopodite I ♂ with acutely pointed apex 48
48 Pleopod-endopodite I ♂ terminally with bulbous enlargement ... *Trichoniscus lindbergi*
– Endopodite terminally without bulbous enlargement ..... *Trichoniscus cavernicola*
49 Tergites covered with few large tubercles or longitudinal ridges; compact body 50
– Tergites with many, sparse small tubercules; soft body ..... *Cordioniscus beroni*
50 Cephalon with many small irregular tubercules; pereion-tergites with four longitudinal ridges; pleonite III with one longitudinal ridge ..... *Monocyphoniscus caniensis*
– Cephalon with distinct large tubercles in two rows; pereion-tergites with more or less rounded tubercles 51
51 Pereion-tergites with two rows of tubercles (Fig. 11) .... *Graeconisus guanophilus* **n. sp.**
– Pereion-tergites with four rows of tubercles 52

52 Pleon only on tergite III with a single tubercle **53**
– Pleon on tergites III-IV with two tubercles **54**
53 Posterior cephalic row with 3 tubercles ..... *Graeconiscus strouhali*
– Posterior cephalic row with 4 tubercles ..... *Graeconiscus thermophilus*
54 Posterior cephalic row with 3 tubercles (Fig. 19) ..... *Graeconiscus kournasensis* **n. sp.**
– Posterior cephalic row with 4 tubercles (Fig. 6) ..... *Graeconiscus caecus*

4 Discussion

A total of 55 species of Oniscidea have been found on Crete and the surrounding islands (Tab. 1), 53 of which are found on Crete, one is endemic of Día Island and one is an Aegean endemic that in the study area has been found only on Día Island. Eleven of the species are troglobitic (with one more found only in caves in the study area, but is not restricted to caves in the rest of its distribution), all of which are endemic in the Cretan archipelago. Two more endemic species have been found outside caves, but their morphology and/or overall distribution indicate a principally cavernicolous life. The non-troglobitic (epigean and endogean) fauna is, thus, restricted to 44 species (42 on the island of Crete), a number that is very low in comparison to other Aegean islands, considering that the surface area of Crete is 8316 km^2 (for example, Samos, with an area of 478 km^2, hosts 35 non-troglobitic species). If the species-area function for the central Aegean islands (see Sfenthourakis 1996a) were to be applied for the Cretan archipelago, the expected number of epigean and endogean species would be around 57. The poverty of isopod species on Crete could be due to the long isolation of this island group, coupled with extensive climatic and habitat changes during this period of isolation. Such a poverty has been recorded also for other animal groups, such as reptiles and terrestrial beetles (Trichas 1996). At the same time, the number of epigean-endogean endemics is not very high (5 epigean endemics – 12 %) in comparison to other regions of Greece (more than 60 % for the total Greek isopod fauna, 20 % for central Aegean islands), or other taxa [e. g. 19 % for Gnaphosidae spiders (Chatzaki 2003), 30 % for land snails (Vardinoyannis 1994)]. On the other hand Crete hosts a rich cavernicolous endemic fauna. The explanation of this situation might be related to the dry climatic conditions encountered on a large part of the island of Crete (increasingly from the western to the eastern part). Indeed, the species richness decreases from west to east (see Tab. 1). The easternmost parts of Crete are more similar to one another, while the western part (department of Chaniá) hosts the most differentiated isopod community. Legakis & Kypriotakis (1994) report a similar pattern for endemic animals of Crete.

The isopod species of the islands surrounding Crete are a subset of the ones inhabiting the main island, and only Día Island shows some differentiation, with one local endemic and one Aegean species that has not been found on Crete (although the latter, an endogean species that is hard to find, should be expected from there). This small island that lies close to Crete hosts several other endemic species and forms (e. g. land snails, see Vardinoyannis 1994), as well as a distinct form of *Armadillo tuberculatus* (Sfenthourakis 1991). Día Island lies outside the 200 m isobath around Crete and might have a relatively long history of isolation from the main island. On the other hand, some of the other surrounding islands, such as Gávdos, are more isolated but do not host local endemics (in contrast with what happens with land snails).

Tab. 1. Species distribution on the islands of the Cretan Archipelago. The four prefectures of the main island are Chaniá (Cha.), Réthymno (Rét.), Irákleio (Irá.) and Lasíthi (Las.). The surrounding islands are Día, Ágria Gramvoúsa (A. Gr.), Pontikonísi (Pont.), Paximádia (Pax.), Avgó and Gávdos (Gáv.). The numbers in brackets stand for cavernicolous species.

	Crete				Día	A. Gr.	Pont.	Pax.	Avgó	Gáv.
	Cha.	Rét.	Irá.	Las.						
Ligia italica Fabricius, 1798	+	+	+	+	+	+	+	+	+	+
Tylos ponticus Grebnicky, 1874	+	+	+	+	+					
Cordioniscus beroni Vandel, 1968		+	+	+	+					
Graeconiscus caecus Vandel, 1958			+							
Graeconiscus guanophilus n. sp.		+								
Graeconiscus kournasensis n. sp.	+									
Graeconiscus strouhali Vandel, 1958				+						
Graeconiscus thermophilus Çağlar, 1948				+						
Monocyphoniscus caniensis (Vandel, 1958)	+	+	+							
Trichoniscus cavernicola Vandel, 1958			+	+						
Trichoniscus fragilis Racovitza, 1908	+		+							
Trichoniscus lindbergi Vandel, 1958	+	+	+	+						
Armadilloniscus ellipticus (Harger, 1878)				+						
Bathytropa granulata Aubert & Dollfus, 1890	+	+	+	+						+
Rodoniscus anophthalmus Arcangeli, 1934					+					
Chaetophiloscia cellaria (Dollfus, 1884)	+	+	+	+	+	+		+	+	+
Philoscia univittata Strouhal, 1937	+									
Halophiloscia couchii (Kinahan, 1858)	+	+	+	+	+					
Halophiloscia hirsuta Verhoeff, 1928	+						+			
Stenophiloscia vandeli Matsakis, 1967	+	+	+	+	+					
Nagurus aegaeus Schmalfuss, 1977				+						
Trachelipus cavaticus n. sp.	+	+								
Trachelipus kytherensis (Strouhal, 1929)	+	+								
Orthometopon phaleronense (Verhoeff, 1901)	+	+	+	+						+
Platyarthrus beieri Strouhal, 1954		+								
Platyarthrus lindbergi Vandel, 1959	+	+								
Platyarthrus schoeblii Budde Lund, 1885	+	+	+	+		+				

Tab. 1 (continued)

Agabiformius lentus (Budde-Lund, 1885)	+	+	+	+						+
Agabiformius obtusus (Budde-Lund, 1909)	+	+	+	+						+
Leptotrichus naupliensis (Verhoeff, 1901)	+	+	+	+						
Porcellio flavomarginatus Lucas, 1853	+	+	+	+						+
Porcellio laevis (Latreille, 1804)	+	+	+	+						
Porcellio lamellatus Budde-Lund, 1885	+	+	+	+		+				
Porcellio obsoletus Budde-Lund, 1885	+	+	+	+						
Porcellionides cavernarum (Vandel, 1958)		+	+							
Porcellionides myrmecophilus (Stein, 1859)	+	+	+	+						
Porcellionides pruinosus (Brandt, 1833)	+	+	+	+		+	+			+
Proporcellio quadriseriatus Verhoeff, 1917	+	+	+	+	+					
Armadillidium bicurvatum Verhoeff, 1901	+									
Armadillidium granulatum Brandt, 1833	+	+	+	+	+					
Armadillidium lymberakisi n. sp.	+									
Armadillidium marmoratum Strouhal, 1929	+	+	+	+						
Armadillidium vulgare Latreille, 1804	+	+	+	+						
Echinarmadillidium cycladicum Schmalfuss & Sfenthourakis, 1995			+		+					
Platanosphaera ariadnae (Vandel, 1958)	+									
Platanosphaera cavernarum (Vandel, 1958)			+	+						
Platanosphaera gavdensis (Schmalfuss, 1972)	+									+
Platanosphaera kournasensis n. sp.	+									
Schizidium delmastroi n. sp.	+									
Schizidium hybridum (Budde-Lund, 1896)	+	+	+	+		+				+
Schizidium perplexum (Vandel, 1958)			+	+						
Schizidium schmalfussi Sfenthourakis, 1992					+					
Trichodillidium mylonasi n. sp.		+								
Armadillo officinalis Duméril, 1816	+	+	+	+						
Armadillo tuberculatus Vogl, 1876	+	+	+	+	+	+		+	+	+
	39 (4)	34 (4)	34 (7)	33 (6)						
TOTAL	**53 (12)**				**12 (1)**	***7***	**3**	**3**	**3**	**11**

On distributional grounds the isopods of the Cretan archipelago can be grouped as follows:

Local endemic	16 (29 %)
Aegean endemic (including Asia Minor coasts)	11 (20 %)
Greek endemic	3 (5.5 %)
Continental Greek	2 (3.6 %)
Transadriatic-Balkan elements	1 (1.8 %)
East Mediterranean	3 (5.5 %)
North Mediterranean	4 (7.3 %)
Mediterranean (incl. the Black Sea and E Atlantic)	11 (20 %)
Cosmopolitan	4 (7.3 %)

It is evident that the Aegean-Mediterranean elements prevail. On the other hand there are certain elements that are indicative of an influence from continental Greece and the Balkans, such as the presence of *Philoscia univittata*, *Trachelipus kytherensis*, *Armadillidium bicurvatum*, and the genus *Trichodillidium*. All these elements are restricted to the western part of Crete, despite the fact that seemingly proper habitats for most of them exist at least in part of the central and eastern parts of the island. It should be noted also that Poulakakis et al. (2003), using molecular data, have found that the Cretan populations of the lizard '*P. erhardii*' belong to the same clade with *P. peloponnesiaca* from the Peloponnese, and not to that of *P. erhardii* populations from the central Aegean. From the existing data on the palaeogeography of Crete, we know that the island was fragmented into separate smaller islands, corresponding roughly to the present day main mountainous masses, until the beginning of the Pleistocene (Meulenkamp et al. 1994). The final break-up of the land connections between Crete and Peloponnese has been estimated at around 5 million years ago (Meulenkamp et al. 1988), but some authors support a partial connection of the western part of Crete with the Peloponnese during the Pleistocene (Azzaroli 1977; Lanza & Vanni 1987), a scenario that could fit the data on isopods. The fragmentation of Crete explains also the occurrence patterns of the troglobitic species, many of which are restricted to (or absent from) one or some of the main mountainous masses.

The occurrence of the endemic new species of *Armadillidium* on high elevations of the mountain Lefká Óri, a species that seems to be very close to *A. marmoratum* (which lives at humid lowland sites), could be attributed to the rapid uplift of Cretan mountains by the end of the Pliocene (Meulenkamp et al. 1994). Further studies, involving also molecular data, are needed to resolve this issue.

From an ecological point of view, the isopod fauna of Crete can be categorised as follows:

a. Species inhabiting the littoral zone. There are 7 species that are restricted to the littoral zone. Six of them, namely *Ligia italica*, *Armadilloniscus ellipticus*, *Halophiloscia couchii*, *H. hirsuta*, *Stenophiloscia vandeli* and *Porcellio lamellatus* inhabit rocky coasts, while *Tylos ponticus* is found mainly in sandy beaches. In addition to these, several other species can also be found at the littoral zone, near the upper part of sandy beaches, without being restricted to it. These include *Agabiformius lentus*, *A. obtusus*, *Leptotrichus naupliensis*, *Proporcellio quadriseriatus*, and *Schizidium hybridum*, as well as most of the myrmecophilous species (*Platyarthrus* spp.,

and *Porcellionides myrmecophilus*). *Armadillidium granulatum* is also present at the littoral zone, especially on hard calcareous substrate.

b. Species inhabiting maquis (hard-leaved, perennial shrub). There are 7 species that are typical of the Mediterranean shrublands, such as *Orthometopon phaleronense*, *Porcellio obsoletus*, *P. flavomarginatus*, *Schizidium hybridum*, *S. schmalfussi*, *Armadillo officinalis*, and *A. tuberculatus*. Most of them can be also found in phrygana or several anthropogenic habitats such as olive cultivations. In these habitats one can also find species like *Agabiformius* spp., *Leptotrichus naupliensis*, *Armadillidium granulatum*, *Echinarmadillidium cycladicum*, and *Platanosphaera gavdensis*, as well as the endogean *Rodoniscus anophthalmus* and the myrmecophilous species, depending on the microhabitat.

c. Species present in riparian habitats. Two species, *Philoscia univittata* and *Trichodillidium mylonasi*, are restricted to riparian habitats with permanent water flow. The first has been found in the dense litter-layer of broad-leaved riparian vegetation, and the latter among wet stones and muddy soil very close to the water flow. *Monocyphoniscus caniensis*, when not in caves, is also restricted to riparian habitats, living under stones and within the litter-layer. Other species that prefer riparian sites are *Trichoniscus lindbergi*, *Bathytropa granulata*, *Chaetophiloscia cellaria*, *Nagurus aegaeus*, *Trachelipus kytherensis*, *Porcellio laevis*, *Armadillidium marmoratum* and *A. vulgare*. All these species prefer very humid sites and can be also found near marshes, in humid litter-layer etc.

d. Species restricted to caves. *Cordioniscus beroni*, *Graeconiscus caecus*, *G. guanophilus*, *G. kournasensis*, *G. strouhali*, *Trichoniscus cavernicola*, *Porcellionides cavernarum*, *S. perplexum*, *Platanosphaera ariadnae*, *P. cavernarum* and *P. kournasensis* are found strictly in caves. *Trachelipus cavaticus* is also found mostly in caves, with a few exceptions, while *Trichoniscus fragilis* is found only in caves within the study area, even though it lives outside caves elsewhere. *Schizidium delmastroi* has been found outside caves, but its morphological characters are indicative of mostly cavernicolous habits, or at least endogean. *Monocyphoniscus caniensis* and *Trichoniscus lindbergi* are found either in caves or at riparian sites.

e. Species restricted to high elevations. There is one species, *Armadillidium lymberakisi*, that is restricted to alpine and sub-alpine habitats, as well as a form of *Porcellio flavomarginatus* that is found only above 1700 m.

f. Anthropophilous species. These include the cosmopolitan species *Porcellionides pruinosus* and *Armadillidium vulgare*, as well as *Armadillidium granulatum* that is found at the coastal zone, usually in habitats rich in calcium, reaching high densities in towns and villages.

g. Species restricted to calcareous substrate. Many species of isopods prefer sites rich in calcium, but *Porcellio flavomarginatus*, *Echinarmadillidium aegaeum* and *Armadillo tuberculatus* are restricted to calcareous substrate.

h. Myrmecophilous species. All species of *Platyarthrus* and *Porcellionides myrmecophilus* are living in or close to ant nests. It is not clear if they have developed commensalism or symbiosis, and if there are species of ants that do not accept their presence.

The overall most abundant species are *Orthometopon phaleronense*, *Porcellionides pruinosus*, *Armadillidium granulatum*, *Armadillidium vulgare*, *Schizidium hy-*

bridum, *Armadillo officinalis* and *A. tuberculatus*, reflecting the current ecology of Crete. At the same time, there are several remnants of a more hygrophilous fauna, biogeographically related to continental Greece, that have a more localised or sparse occurrence.

5 References

Andreev, S. (1986): Contribution à l'étude des isopodes terrestres de la Grèce. 3. Sur trois nouvelles espèces des genres *Cordioniscus*, *Alpioniscus* et *Trichoniscus* et nouvelles données sur les isopodes terr. – Biologia gallo-hellenica **11**: 153–164.

Arcangeli, A. (1934): Nuovi contributi alla conoscenza della fauna delle isole dell'Egeo. III. Isopodi terrestri. – Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici **28**: 37–69.

Azzaroli, A. (1977): Considerationi sui mammiferi fossili delle isole mediterranee. – Bollettino zoologico **44**: 201–211.

Budde-Lund, G. (1896): Land-Isopoden aus Griechenland, von E. v. Oertzen gesammelt. – Archiv für Naturgeschichte **62**: 39–48.

Çağlar, M. (1948): Eine neue *Haplophthalmus*-Art und Bemerkung über ihre Augen. – İstanbul Üniversitesi Fen Fakültesi Mecmuasi, Seri B **13**: 161–169.

Caruso, D., Baglieri, C., di Maio, M. & Lombardo, B. (1987): Isopodi terrestri di Sicilia ed isole circumsiciliane (Crustacea, Isopoda, Oniscoidea). – Animalia **14**, Supplemento: 5–211.

Cecconi, G. (1895): Ricordi zoologici di un viaggio all'Isola di Candia. – Bollettino della Società entomologica italiana **27**: 169–222.

Chatzaki, M. (2003): Ground spiders of Crete (Araneae, Gnaphosidae): taxonomy, ecology & biogeography. – PhD thesis, University of Crete, 452 pp.

Cruz, A. (1989): Isópodos terrestres de Menorca (Crustacea, Isopoda, Oniscidea). – ENDINS (Palma de Mallorca) **14–15**: 89–93.

Cruz, A. (1994): Redescripción de *Agabiformius obtusus* y de *Armadillo hirsutus* de la Península Ibérica. – Butlletí de la Institució Catalana d'Història Natural **62**: 65–76.

Dalens, H. (1970): Un nouveau représentant du genre *Cordioniscus* (Isopoda, Oniscoidea, Styloniscidae) récolté en Grèce du Nord. – Biologia gallo-hellenica **3**: 105–108.

Erhard, F. (1998): Phylogenetic relationships within the Oniscidea (Crustacea, Isopoda). – Israel Journal of Zoology **44**: 303–309.

Ferrara, F. & Taiti, S. (1978): Gli isopodi terrestri dell'Arcipelago Toscano. Studio sistematico e biogeografico. – Redia **61**: 1–106.

Garcia, L. & Cruz, A. (1996): Els isòpodos terrestres (Crustacea: Isopoda: Oniscidea) de les Illes Balears: catàleg d'espècies. – Bolletí de la Societat d'Història natural de les Balears **39**: 77–99.

Garthwaite, R., Lawson, R. & Taiti, S. (1992): Morphological and genetic relationships among four species of *Armadilloniscus* (Isopoda: Oniscidea: Scyphacidae). – Journal of natural History **26**: 327–338.

Harding, P. & Sutton, S. (1985): Woodlice in Britain and Ireland: Distribution and habitat, 151 pp.; Abbots Ripton (Institute of Terrestrial Ecology).

Karaman, M. (1966): Kopnezi izopodi (Isopoda terrestria) Jugoslavije. – Zbornik radova filozofskog Fakulteta, Univerzitet u Prištini **3**: 371–404.

Lanza, B. & Vanni, S. (1987): Hypotheses on the origin of the Mediterranean island batrachofauna. – Bulletin de la Société zoologique de France **122**: 179–196.

Legakis, A. & Kypriotakis, Z. (1994): A biogeographical analysis of the island of Crete. – Journal of Biogeography **21**: 441–445.

Leistikow, A. & Wägele, J. (1999): Checklist of the terrestrial isopods of the new world (Crustacea, Isopoda, Oniscidea). – Revista brasileira de Zoologia **16**: 1–72.

Lemos de Castro, A. (1962): Sôbre a distribução geográfica do género *Halophiloscia* Verhoeff. – Boletim do Museu nacional Rio de Janeiro, Nova Serie, Zoologia **238**: 7 pp.

Lucas, H. (1853): Essai sur les animaux articulés qui habient l'île de Crète. – Revue et Magasin de Zoologie **5**: 466–468, pl. 16.

Lymberakis, P., Mylonas, M. & Sfenthourakis, S. (2003): Altitudinal variation of onis-

cidean communities on Cretan mountains. – In: SFENTHOURAKIS et al. (eds.): The Biology of Terrestrial Isopods V, Crustaceana Monographs **2**: 217–230.
MATSAKIS, J. (1967): Notes sur les isopodes de Grèce. I. Une nouvelle espèce de *Halophiloscia* (*Stenophiloscia*), oniscoide. – Biologia gallo-hellenica **1**: 53–57.
MATSAKIS, J. (1972): Récolte en Crète d'une variété intéressante d'*Halophiloscia couchi*. – Biologia gallo-hellenica **4**: 109–112.
MEULENKAMP, J., WORTEL, M., VAN WAMEL, W., SPAKMAN, W. & HOOGERDUYN STRATING, E. (1988): On the Hellenic subduction zone and the geodynamic evolution of Crete since the late Middle Miocene. – Tectonophysics **146**: 203–215.
MEULENKAMP, J., VAN DER ZWAAN, G. & VAN WAMEL, W. (1994): On Late Miocene to recent vertical motions in the Cretan segment of the Hellenic arc. – Tectonophysics **234**: 53–72.
PARAGAMIAN, K., GALANOPOULOS, V., LEGAKIS, A. & SPANAKIS, M. (1987): Ecological, electrophoretic and electron microscope investigations on *Schizidium perplexum* from Crete. – Biologia gallo-hellenica **13**: 165–168.
POULAKAKIS, N., LYMBERAKIS, P., ANTONIOU, A., CHALKIA, D., ZOUROS, E., MYLONAS, M. & VALAKOS, E. (2003): Molecular phylogeny and biogeography of the wall-lizard *Podarcis erhardii* (Squamata: Lacertidae). – Molecular Phylogenetics and Evolution **28**: 38–46.
RACOVITZA, E. (1908): Isopodes terrestres (seconde série). – Archives de Zoologie expérimentale et générale, 4e Serie, **9**: 239–415.
SCHMALFUSS, H. (1972a): Die Isopoden von Kreta.– Biologia gallo-hellenica **4**: 33–60.
SCHMALFUSS, H. (1972b): Zwei neue Landisopoden aus Griechenland (Crustacea: Isopoda). – Senckenbergiana biologica **53**: 427–430.
SCHMALFUSS, H. (1975): Neues Isopoden-Material aus Griechenland. – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **184**: 27–66.
SCHMALFUSS, H. (1978): Morphology and function of cuticular micro-scales and corresponding structures in terrestrial isopods (Crust., Isop., Oniscoidea). – Zoomorphologie **91**: 263–274.
SCHMALFUSS, H. (1979): Revidierte Check-list der Landisopoden (Oniscoidea) Griechenlands. – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **331**: 42 pp.
SCHMALFUSS, H. (1981): Die Landisopoden (Oniscoidea) Griechenlands. 2. Beitrag: Gattung *Armadillidium*, Teil I (Armadillidiidae). – Spixiana **4**: 275–289.
SCHMALFUSS, H. (1985): Die Landisopoden (Oniscidea) Griechenlands. 6. Beitrag: Gattung *Armadillidium*, Teil III (Armadillidiidae). – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **193**: 289–301.
SCHMALFUSS, H. (1988): The terrestrial isopod genus *Schizidium* in western Asia (Oniscidea: Armadillidiidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **423**: 22 pp.
SCHMALFUSS, H. (1989): Die Land-Isopoden (Oniscidea) Griechenlands. 10. Beitrag: Gattung *Trichodillidium* g. n. (Armadillidiidae). – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **197**: 207–214.
SCHMALFUSS, H. (1990a): Die Landisopoden (Oniscidea) Griechenlands. 11. Beitrag: Gattung *Chaetophiloscia* (Philosciidae). – Revue suisse de Zoologie **97**: 169–193.
SCHMALFUSS, H. (1990b): Die Land-Isopoden (Oniscidea) Griechenlands. 12. Beitrag: Gattungen *Lepidoniscus* und *Philoscia* (Philosciidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **448**: 11 pp.
SCHMALFUSS, H. (1991): The terrestrial isopod genus *Chaetophiloscia* in western Asia (Oniscidea: Philosciidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **463**: 9 pp.
SCHMALFUSS, H. (1992): The terrestrial isopod genus *Porcellio* in western Asia (Oniscidea: Porcellionidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **475**: 45 pp.
SCHMALFUSS, H. (1993): Die Land-Isopoden Griechenlands. 13. Beitrag: Gattung *Orthometopon*. – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **498**: 44 pp.
SCHMALFUSS, H. (1994): Die Land-Isopoden (Oniscidea) Griechenlands. 14. Beitrag: Gattung *Nagurus* (Trachelipodidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **509**: 23 pp.

SCHMALFUSS, H. (1996): The terrestrial isopod genus *Armadillo* in western Asia (Oniscidea: Armadillidae), with descriptions of five new species. – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **544**: 43 pp.

SCHMALFUSS, H. (1999): Terrestrial isopod records from Greek islands. – Newsletter, Hellenic zoological Society **31**: 5–7.

SCHMALFUSS, H. (2000a): The terrestrial isopods (Oniscidea) of Greece. 20th contribution: Genus *Leptotrichus* (Porcellionidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **618**: 64 pp.

SCHMALFUSS, H. (2000b): Distributional patterns in the Greek species of the terrestrial isopod genus *Armadillidium*. – Belgian Journal of Zoology **130**, Supplement: 77–82.

SCHMALFUSS, H. (2003): World catalog of terrestrial isopods (Isopoda: Oniscidea). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **654**: 341 pp.

SCHMALFUSS, H. & ERHARD, F. (1998): Die Land-Isopoden (Oniscidea) Griechenlands. 19. Beitrag: Gattung *Cordioniscus* (Styloniscidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **582**: 20 pp.

SCHMALFUSS, H. & SCHAWALLER, W. (1984): Die Fauna der Ägäis-Insel Santorin. Teil 5. Arachnida und Crustacea. – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **371**: 16 pp.

SCHMALFUSS, H. & SFENTHOURAKIS, S. (1995): The terrestrial isopods (Oniscidea) of Greece. 15th contribution: Genera *Echinarmadillidium* and *Paxodillidium* (Armadillidiidae). – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **518**: 21 pp.

SCHMALFUSS, H. & VERGARA, K. (2000): The isopod genus *Tylos* (Oniscidea: Tylidae) in Chile, with bibliographies of all described species of the genus. – Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) **612**: 42 pp.

SCHMIDT, C. (1997): Revision of the European species of the genus *Trachelipus* (Crustacea: Isopoda: Oniscidea). – Zoological Journal of the Linnean Society **121**: 129–244.

SCHMIDT, C. (2003): Contribution to the phylogenetic system of the Crinocheta (Crustacea, Isopoda). Part 2 (Oniscoidea to Armadillidiidae). – Mitteilungen aus dem Museum für Naturkunde in Berlin (Zoologische Reihe) **79**: 3–179.

SCHULTZ, G. (1972): Ecology and systematics of terrestrial isopod crustaceans from Bermuda (Oniscoidea). – Crustaceana, Supplement **3**: 79–99.

SFENTHOURAKIS, S. (1991): The subspecific problem of *Armadillo tuberculatus* Vogl, 1876 (Isopoda, Oniscidea). – In: JUCHAULT, P. & MOCQUARD, J. (eds.): The Biology of Terrestrial Isopods III, University of Poitiers, pp. 17–22.

SFENTHOURAKIS, S. (1992): New species of terrestrial isopods (Isopoda, Oniscidea) from Greece. – Crustaceana **63**: 199–209.

SFENTHOURAKIS, S. (1993): Terrestrial isopods (Crustacea: Oniscidea) from the remote Greek island Antikithira and its surrounding islets. – Revue suisse de Zoologie **100**: 613–626.

SFENTHOURAKIS, S. (1994): Biogeography, systematics and ecological aspects of terrestrial isopods in central Aegean islands. – PhD. thesis, University of Athens, 293 pp. [in Greek, with English summary].

SFENTHOURAKIS, S. (1996a): The species-area relationship of terrestrial isopods (Isopoda; Oniscidea) from the Aegean archipelago (Greece): a comparative study. – Global Ecology and Biogeography Letters **5**: 149–157.

SFENTHOURAKIS, S. (1996b): A biogeographical analysis of terrestrial isopods from the central Aegean islands (Greece). – Journal of Biogeography **23**: 687–698.

STROUHAL, H. (1929a): Die Landisopoden des Balkans. 3. Beitrag: Südbalkan. – Zeitschrift für wissenschaftliche Zoologie **133**: 57–120.

STROUHAL, H. (1929b): Über neue und bekannte Landasseln des Südbalkans im Berliner Zoologischen Museum. – Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin **1929**: 37–80.

STROUHAL, H. (1936): Zoologische Forschungsreise nach den Ionischen Inseln und dem Peloponnes. XVII. Teil. Isopoda terrestria, I: Ligiidae, Trichoniscidae, Oniscidae, Porcellionidae. – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **145**: 153–177.

STROUHAL, H. (1937a): Isopodi terrestri Aegaei. – Acta Instituti et Musei zoologici Universitatis atheniensis **1**: 198–262.

STROUHAL, H. (1937b): Neue Oniscoidea des Südbalkans. – Zoologischer Anzeiger **117**: 119–129.

STROUHAL, H. (1937c): Landisopoden der Dodekanes. – Zoologischer Anzeiger **119**: 1–11.
STROUHAL, H. (1940): *Moserius percoi* nov. gen. nov. spec., eine neue Höhlen-Höckerassel, nebst einer Übersicht über die Halplophthalminen. – Zoologischer Anzeiger **129**: 13–30.
STROUHAL, H. (1954): Zoologische Studien in West-Griechenland. IV. Teil. Isopoda terrestria, I: Ligiidae, Trichoniscidae, Oniscidae, Porcellionidae, Squamiferidae. – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **163**: 559–601.
STROUHAL, H. (1956): Zoologische Studien in West-Griechenland. VI. Teil. Isopoda terrestria, II: Armadillidiidae, Armadillidae. – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **165**: 585–618.
STROUHAL, H. (1963): Die *Haplophthalmus*-Arten der Türkei. – Annalen des naturhistorischen Museums in Wien **66**: 385–406.
STROUHAL, H. (1965): Ergebnisse der Zoologischen Nubien-Expedition 1962. Teil XXX. Isopoda terrestria. – Annalen des naturhistorischen Museums in Wien **68**: 609–629.
STROUHAL, H. (1966): Ein weiterer Beitrag zur Süßwasser- und Landasselfauna Korfus. – Sitzungsberichte der österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung I, **175**: 257–315, pls. 1–6.
STROUHAL, H. (1968): Die Landisopoden der Insel Zypern. – Annalen des naturhistorischen Museums in Wien **72**: 299–387.
TAITI, S. & FERRARA, F. (1996): The terrestrial Isopoda of Corsica (Crustacea, Oniscidea). – Bulletin du Muséum national d'Histoire naturelle, Paris, 4e Serie, Section A, **18**: 459–545.
TAITI, S., FERRARA, F. & DAVOLOS, D. (2000): The terrestrial Isopoda (Crustacea: Oniscidea) of Oman. – Fauna of Arabia **18**: 145–163.
TRICHAS, A. (1996): Ecology and biogeography of ground beetles in southern Aegean, with emphasis on the composition, the seasonal and habitat differentiation, and the zoogeography of the families Carabidae and Tenebrionidae. – PhD thesis, University of Crete, 395 pp. [in Greek, with English summary].
VANDEL, A. (1955): Mission HENRI COIFFAIT au Liban (1951). 8. Isopodes terrestres. – Archives de Zoologie expérimentale et générale **91**: 455–531.
VANDEL, A. (1958): Isopodes récoltés dans les grottes de la Crète par le Docteur K. LINDBERG. – Notes biospéologiques **12**: 81–101.
VANDEL, A. (1959): La faune isopodique cavernicole de la Grèce continentale (Récoltes du Dr. K. LINDBERG, Lund). – Notes biospéologiques **13**: 131–140.
VANDEL, A. (1960): Faune de France, **64**. Isopodes terrestres (première partie), pp. 1–416.
VANDEL, A. (1962): Faune de France, **66**. Isopodes terrestres (deuxième partie), pp. 417–931.
VANDEL, A. (1964): Les isopodes cavernicoles récoltés en Grèce par le Docteur H. HENROT. – Annales de Spéléologie **19**: 729–740.
VANDEL, A. (1968): Description d'un nouveau représentant du genre *Cordioniscus* (Crustacea, Isopoda, Oniscoidea, Styloniscidae) suivie de considérations sur les voies de migration de certaines lignées d'isopodes terrestres. – Annales de Spéléologie **23**: 621–632.
VARDINOYANNIS, K. (1994): Biogeography of land snails in the south Aegean island arc. – PhD thesis, University of Athens, 330 pp. [in Greek, with English summary].
VERHOEFF, K. (1929): Eine neue Diplopoden- und eine neue Isopoden-Gattung aus dem Labyrinth Kretas. – Mitteilungen über Höhlen- und Karstforschung **4**: 113–123.
VERHOEFF, K. (1941): Über Land-Isopoden aus der Türkei. – Istanbul Üniversitesi Fen Fakültesi Mecmuasi, Seri B, **4**: 223–276.

Authors' addresses:

Dr. HELMUT SCHMALFUSS, Staatliches Museum für Naturkunde, Rosenstein 1, 70191 Stuttgart, Germany; e-mail: schmalfuss.smns@naturkundemuseum-bw.de
KALOUST PARAGAMIAN, Hellenic Institute of Speleological Research, P.O. Box 2240, 71409 Irakleio, Greece; e-mail: paragam@in.gr
Dr. SPYROS SFENTHOURAKIS, Section of Animal Biology, Department of Biology, University of Patras, 26500 Patras, Greece; e-mail: sfendo@upatras.gr

Manuscript received: 16.I. 2004, accepted: 23.II. 2004.

ISSN 0341-0145

Autoren-Richtlinien: http://www.naturkundemuseum-bw.de/stuttgart/schriften
Schriftleitung: Dr. Hans-Peter Tschorsnig, Rosenstein 1, 70191 Stuttgart
Gesamtherstellung: Gulde-Druck GmbH, 72072 Tübingen